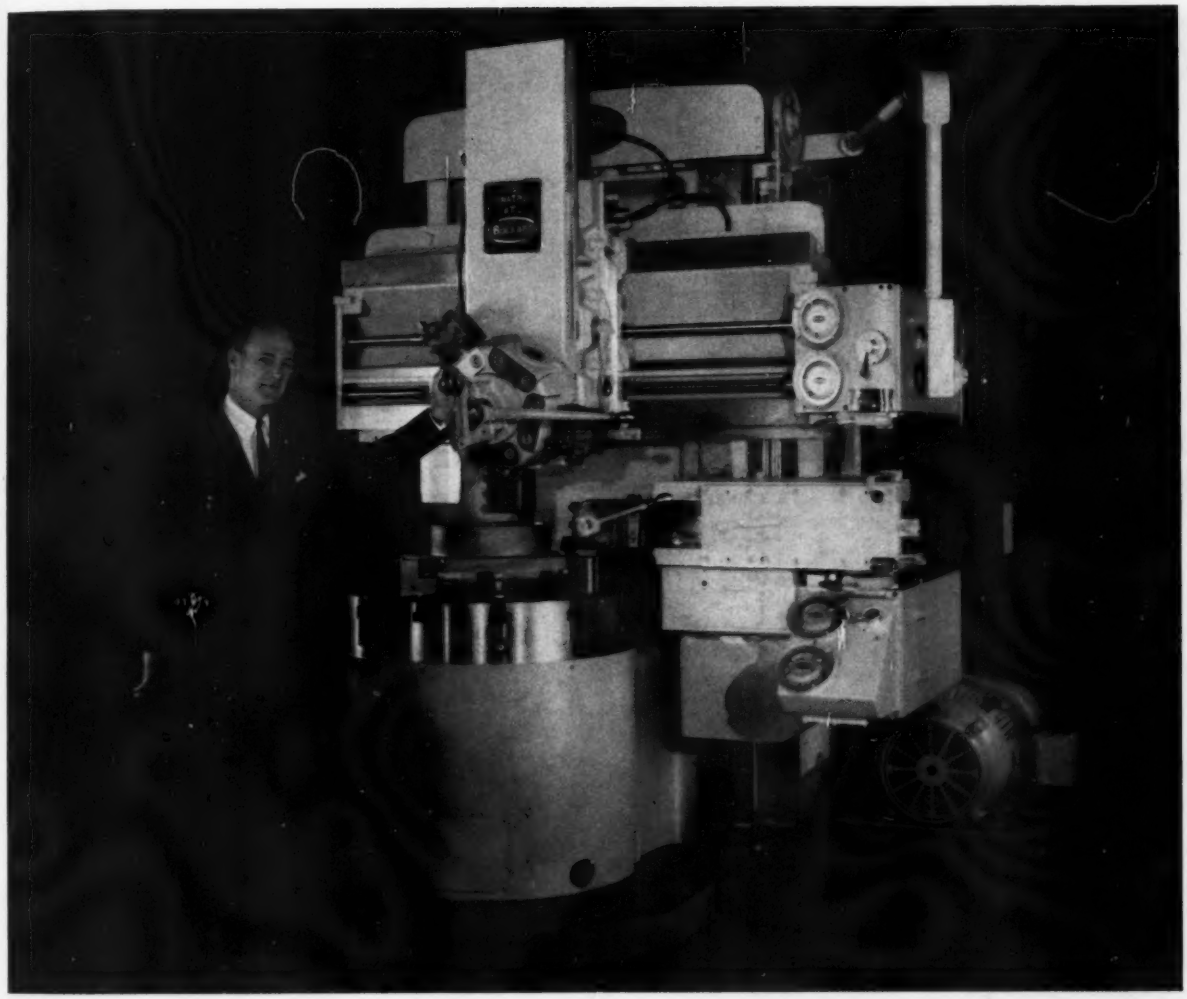
JANUARY 1960

TOOLING & PRODUCTION

Magazine



E.P. Bullard and his new Dynatrol VTL . . . page 36

Convert Stamping Press to 'Production Department' . . . page 37

Complete Table of Contents . . . Inside Cover

3 REASONS WHY

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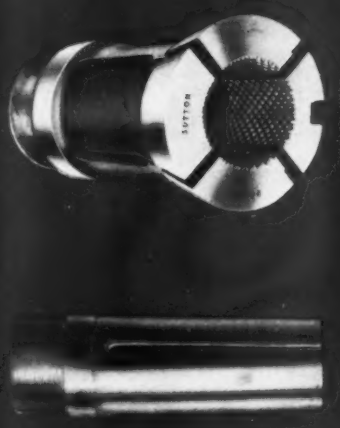

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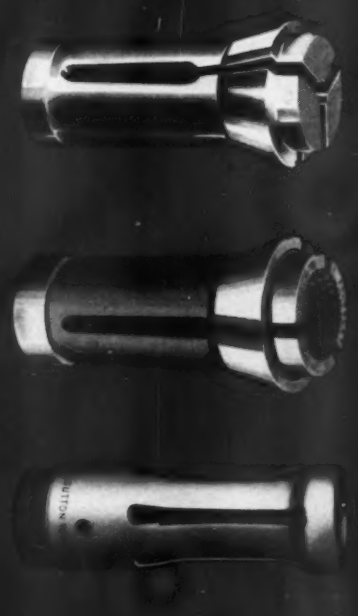

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TOOLING & PRODUCTION Magazine

Vol. XXV, No. 10

JANUARY 1960

FEATURES

Managing Quality for Maximum Profits 9
—Talk of the Month by Charles A. Bicking

Foreign Competition vs. Our Standard of Living 33
The Editorial by E. Willard Pennington

Common Sense and Tape Control 35
by Clarke Redfield

A thoughtful and thought-provoking page on the dollar and cents merits of numerical control, as told by a machine tool user.

E. P. Bullard and His New VTL 36
Some details on this month's cover.

How to Convert: From Stamping Press to 'Production Department' 37
by E. Willard Pennington

The story of the evolution of a press tooling program that combines a "scrapless" carbide blanking die and associated equipment in such a way that coil stock is fed in one end and finished, assembled motor rotor laminations and laminated field assemblies come out the other.

Not-So-Special Special Machines 42

Almost a do-it-yourselfer. A special machine from knock - 'em - down and use - 'em - over building block components, set up for a drilling job.

Meet the Computer, Mr. Production Man 43
by Charles Weiner

A simple, clearly written account of electronic computer principles to give you at least a "speaking acquaintance" with their operation and use in industry.

Tooling Up the Numerically Controlled Milling Machine 48
by Joseph Albert

Problems and steps involved in readying a tape controlled miller for production at a Lockheed plant.

continued on reverse side . . .

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New Executive Line-Up for NMTBA **50**

Spinning Big Stuff — Hot and Cold **52**
by K. Casavant & F. F. Fabio

An ancient process gets a face-lifting, by adding hydraulics, for working space-age metals and parts. Here are principles and examples of spinning's uses.

Electrolytic Marking on a Production Basis **56**

Some examples of how manufacturers are putting electrolytic marking to work by adding relatively simple but extremely useful fixtures.

Who Owns the Invention? **58**
by Albert Woodruff Gray

Employees don't always sell their inventive brains to their employers, and examples from court records indicate who owns patents and inventions, and why.

DEPARTMENTS

Personally Speaking ... 4
Manufacturing Memos..20
New Calling Cards 67
Men You Should Know.68
Catalogs—and other helpful literature 72
Product News 88
Cumulative Editorial Index 118

Coming in the February T&P—

Cut Second Operations on Screw Machines

The Dilemma of Depreciation

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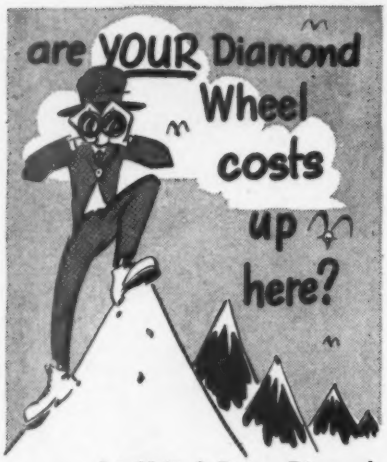

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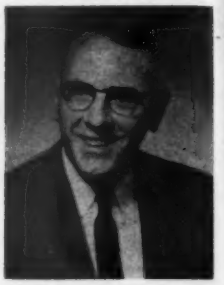
1885 - 1956



personally speaking . . .

Dear T & P Reader:

This issue of Tooling & Production Magazine includes a noteworthy change. In September of this year, the members of the National Machine Tool Builders' Association will be your hosts at a Machine Tool Exposition to be held in Chicago. All through 1960, up to the time of the Exposition, you will be reading about new machines which you will have the opportunity to see under one roof in September. This coming Machine Tool Exposition has prompted us to use our front cover during 1960 to bring to your attention some of the new machines that will become available through the year.

The cover of this issue displays a typical example of what we hope to show you many more of during 1960. You can read about the new Bullard VTL elsewhere in this issue so there is no point in my commenting further here except to say that I have seen the machine and learned considerable about it and it appears to have tremendous potentialities for anyone requiring this type of unit. Our February issue will have another noteworthy unit. In fact, we think you will find that all of the cover features will be extremely interesting in 1960.

We haven't lost sight of the fact that readers of Tooling & Production have expressed great preference for the Editorial Index we have been printing on the cover each month. So that you won't miss it hardly at all, we're including it on a special page just inside the front cover. It will be available for very quick reference in that same position in each issue. We hope you will approve.

Recently, the American Society for Metals was host to a group of editors and publishers at its new headquarters. Elsewhere in this issue you will find description of the new ASM layout. But of far greater importance is the significance of the Geodesic Dome and the semi-circular building which nestles under it. It is difficult to express in words the feeling I had as I toured the area. My reaction was that the whole project is indeed a fitting tribute to what has gone on in the development of metals over the years. And at the same time, it excites interest and lays down a challenge for even greater progress in the future.

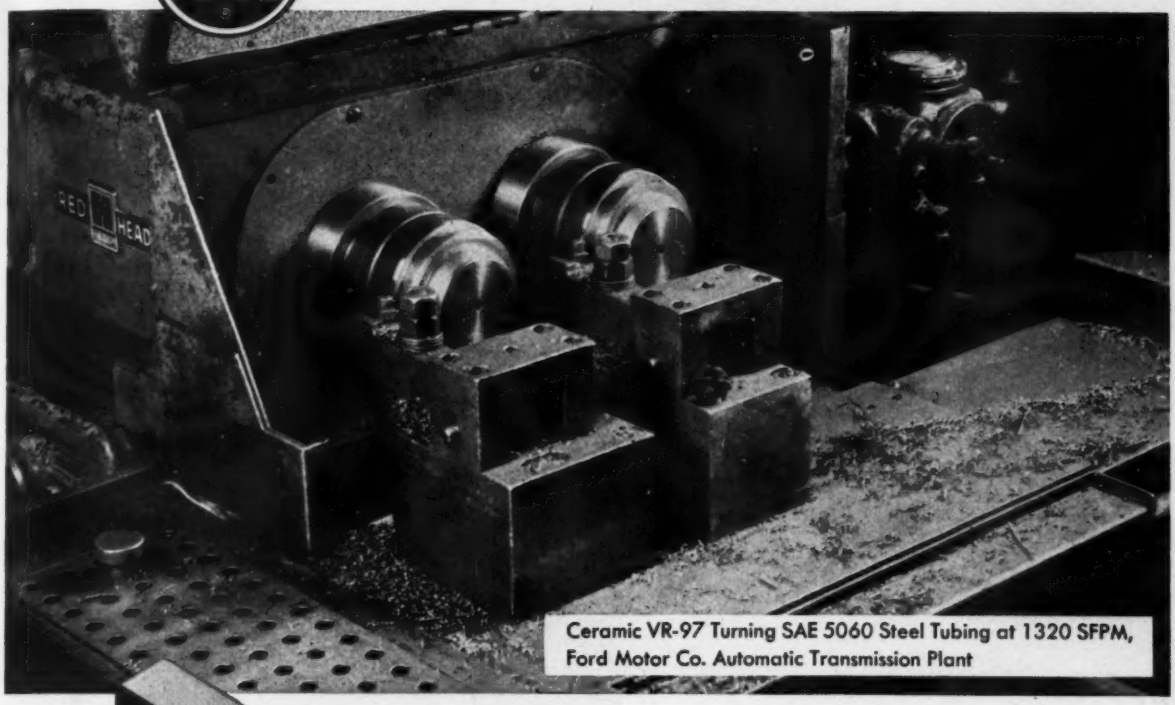
If you ever get to this part of Ohio, by all means at least drive past the new ASM headquarters. I'm sure you would be welcome at any time to tour the grounds and get a close up of the dome and the outside of the building. I can assure you it will be well worth your while to pay the place a visit.

Cordially yours,

Ray Huebner

Publisher

V-R Ceramic VR-97



Ceramic VR-97 Turning SAE 5060 Steel Tubing at 1320 SFPM, Ford Motor Co. Automatic Transmission Plant

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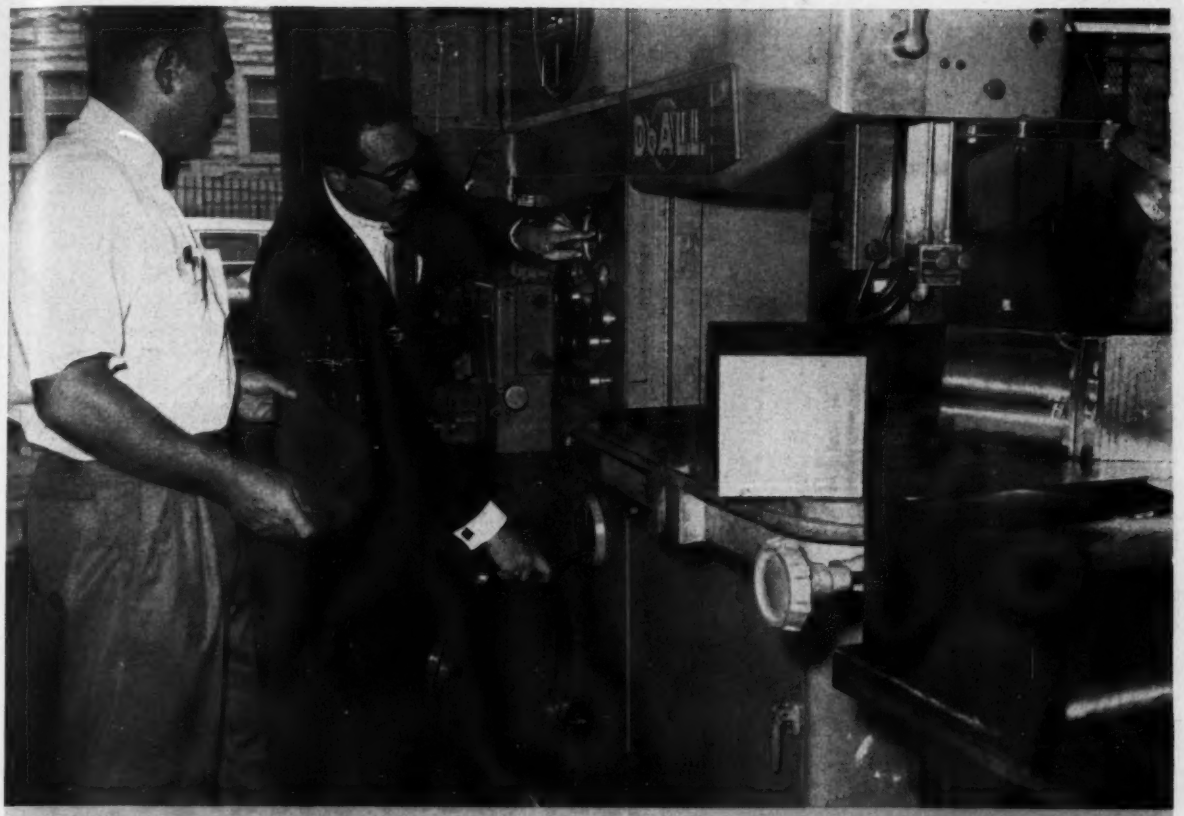

Your DoALL sawing specialist can help you get all the benefits of band machining

Laneko Engineering Company of Philadelphia has had wide experience in the contour cutting of metals with DoALL Band Saws. They used a DoALL Model V-36 and were well satisfied with the results. Then they added a new DoALL 26-3 and overnight graduated from band sawing to band machining.

In a typical test Bill Cole, sawing specialist of the DoALL Philadelphia Company, demonstrated that band machining could deliver tremendous savings in cutting time. The job, shown in the photo, consisted of contour cutting a block of AISI#4140 steel, 6½" x 6½" x 17". Formerly this took 10½ hours. With a power table replacing the old hand feed and following Bill Cole's recommendation of using a Demon* HSS Blade, the job was completed in just three hours—a 72% saving in time alone.

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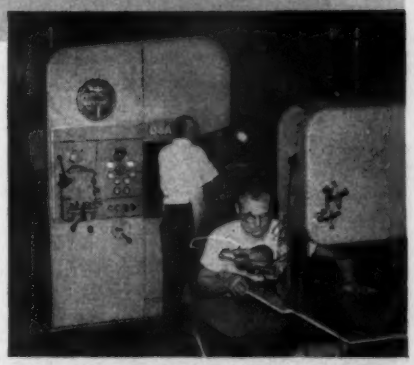

Large photo: Bill Cole of DoALL Philadelphia Company discussing proper feed, speed and blade with Mr. William Neff, Jr. (left) of Laneko Engineering Company. Small photo: both V-36 and new 26-3 DoALL Band Saws working side by side at Laneko.

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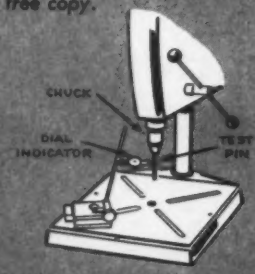

In the meantime, you can make an accuracy test by this method: Fit a hardened test pin into the chuck. Clamp a dial indicator to the machine so that its point touches the test pin an inch or more below the chuck. If runout is indicated, remove the chuck and repeat test on the arbor or spindle to determine the offending part.

Dirt or chips in the chuck arbor hole can cause runout, so can bent spindles or loose bearings. *Look for the real cause.*

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CIRCLE INFORM-A-GRAM KEY NO. 8

Talk of the Month

Managing Quality for Maximum Profits

by Charles A. Bicking

THE GOAL of quality management is to achieve a quality of products that is competitive and optimally profitable.

The organization should follow the sound principle that whoever is responsible for achieving proper quality in manufacture should not also be responsible for what constitutes the proper quality against which the achieved level will be judged.

The exact organizational chart is not important and may vary from company to company. There must be a clear separation, however, of the function of manufacturing quality into the product and the function of prescribing the quality standards and assessing the degree of success achieved in meeting the standards.

The first is a line responsibility that cannot be taken from the manufacturing supervision; the second, a staff function that must be free of the biases that arise when the maker judges his own product.

Mr. Bicking, Manager of Carborundum's Quality Control Branch, Research and Development Division, presented this talk at a session of a recent University of Alabama Q-C Conference.

Channels of Management

In a large, multi-plant company there may be three **main** channels of quality management: The manufacturing lines, the plant Quality Control staffs, and a central Quality Control staff.

How do small organizations which cannot justify the staff organizations get along? Three types of problems may be handled as follows:

1. Continuing quality problems, such as the assessment of quality of final product, may be carried out by the general manager or a designee who does not have conflicting manufacturing interests.

2. Intermittent problems needing the presence of a Q-C engineer, such as initiating procedures, may be carried out by a designee of the manager or by an adviser or an outside consultant.

3. Problems that can be solved in absentia, such as assistance with computing, can be performed in a central office or by a consultant.

. . . Month's Talk from page 9

Note that none of the foregoing relieves the manufacturing organization from carrying out the Quality Control procedures, including the statistical ones, necessary to build quality into the product.

Keeping the three main channels in mind, we may explore the functions of each. It is clear that the inspectors, analysts, statistical clerks, and Q-C engineers who execute the directions of manufacturing supervision and apply the specifications and standards are very active people.

The staff statisticians, Q-C engineers, specification writers, special laboratory personnel, and liaison engineers in the manufacturing plants are the planners and advisors. They lay down the requirements and verify that they have been met.

The company's central Quality Control staff of mathematicians, statisticians, Q-C engineers, computing specialists, and measurement specialists supply expert advice and assistance. They help design complex experiments and carry out systems analysis and operations research.

These activities are tied together by a set of quality documents — drawings, product specifications, descriptions of manufacture, and inspection procedures — which helps separate manufacturing and technical responsibilities and provides a basis for reproducing quality at another time and place.

Manufacturing Function

In the manufacturing line activities, there must be people who can be entrusted with obtaining samples of raw materials, in-process materials, or final product and making precise measurements on them. There must be record keepers who keep a clear and continuous account of sampling and testing results . . . people with arithmetical capability who can analyze the figures and who can prepare tabulations or charts for interpretation . . . people who can use the figures to make decisions regarding the acceptance of raw materials, the adjustment of the production processes, or the disposition of semi-finished materials or final products.

There must be engineers who can recognize the indications of trouble, who can investigate the difficulties and suggest or apply the remedies. Although the trouble areas may be well known in general, Statistical Quality Control provides detailed clues that lead to positive action for logical, stepwise correction of the deficiencies. Finally, there must be those who coordinate all these activities, who see to it that the system works and that none of the guidelines are relaxed without the approval of the technical staff.

These people are organized to build quality into the product rather than to sort bad material as it is made; they become skilled in identifying potential trouble spots and preventing the manufacture of out-of-specification material rather than in putting out brush fires.

. . . Continued on page 12

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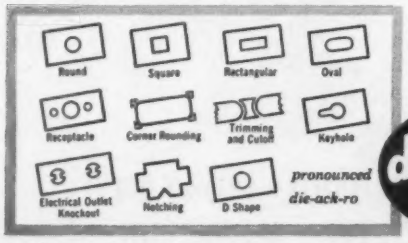

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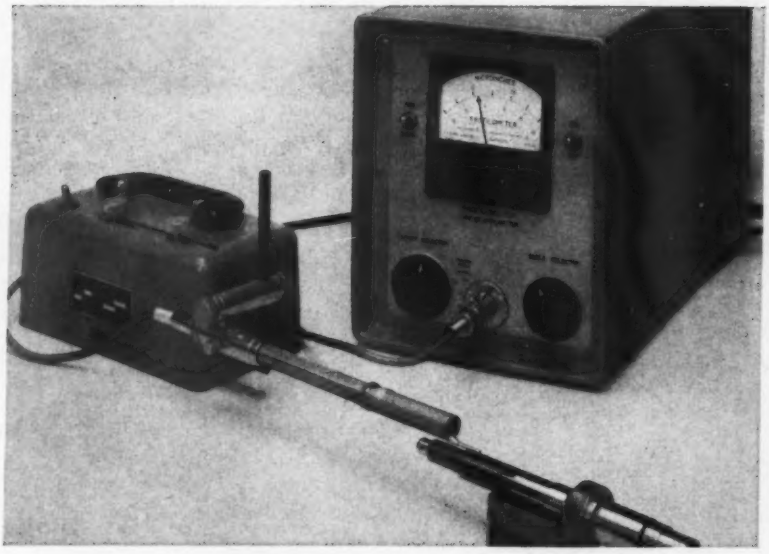

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CIRCLE INFORM-A-GRAM KEY NO. 12

... Month's Talk from page 10

Plant Quality Staff

The staff group possesses the plant's quality conscience. They keep their eyes on the whole quality picture, develop the guidelines, and keep open the channels of communication. They examine the original concept of the quality required of a product to see if it is producible consistently and if it is consistent with the market's need.

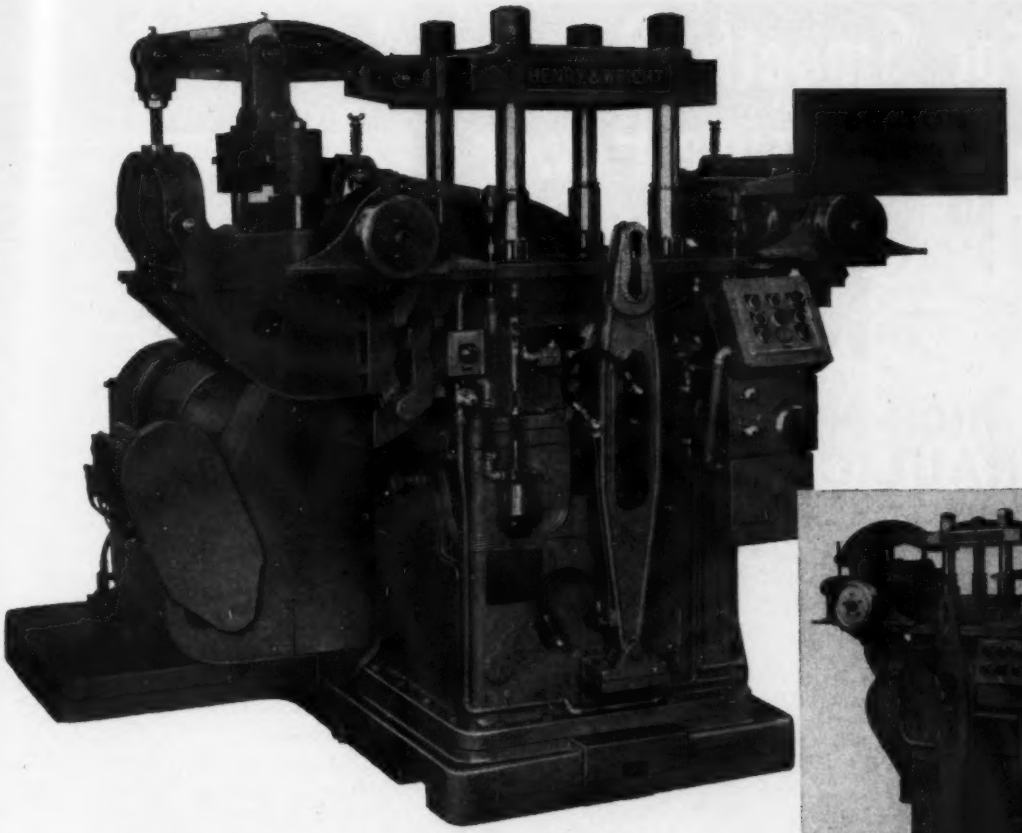
With the advice of other technical, sales, and manufacturing groups they prepare the specifications. Specification writing requires sharp attention to statistical details because a complete specification not only describes a product physically, but also defines its level of quality and the limits within which the quality may vary by describing clearly how the conformance of the product with the requirement shall be verified.

This group is conscious of the cost of quality and it must see to it that costs can be allocated to inspection, laboratory testing, spoilage during manufacture, returns from customers, and to Statistical Quality Control. They are concerned with the hidden costs of quality, such as over-making on orders, wasteful production or inspection practices, or an excess baggage of paper work.

These staff people introduce Statistical Q-C procedures to develop information on the process and a feed-back system which leads to corrective action on a current basis. When properly functioning, this system locates potential trouble spots before the trouble arises, corrects the causes of poor quality before they take on the proportions that attract managerial attention, and makes economic quality the foremost concern of all concerned.

Technical liaison is another logical function of the quality department because one of the requisites of good quality is good communication. So, there must be those who know the needs and the trends of the market, who can translate these requirements to product modifications, who can guide the manufacture of trial orders and of

... Continued on page 14



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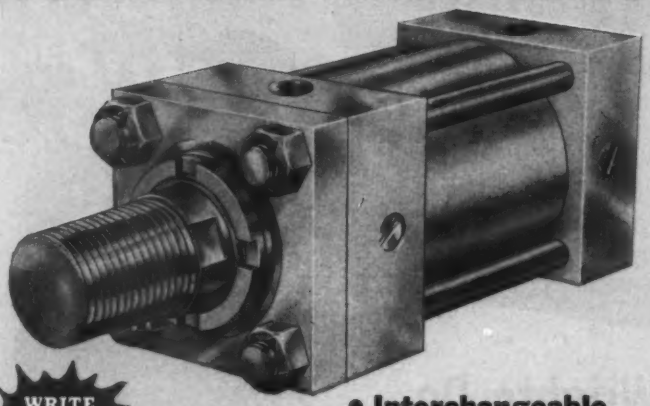

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. . . Month's Talk from page 12

tests in the field, and who can coordinate all the sales, developmental, Quality Control, engineering, and manufacturing talents to arrive at a sound specification and a profitable method of manufacture.

The activities of the Q-C department begin with incoming raw materials and end with final product. It is supported by statisticians and special laboratory staffs because it must devise sampling plans which will vary from the raw material state, the semi-finished state, to the final product state. Special testing skills may be needed at some of these stages. The study of variation in materials or testing or processing will require skill in the planning of experiments and such experimentation should be much better coordinated than in the past. A consistent statistical record of quality is a pre-requisite of better coordination.

Although most of this work is done as a staff service to manufacturing, the Quality Control department will independently sample and test the final product to assure plant management of the maintenance of the quality of outgoing product. This quality audit may or may not extend to verifying every order or lot, but it will require large enough samples to show that the general level of quality is being maintained. The rate of sampling will be small compared to the in-process testing by line Q-C.

Since the keys to the definition of quality and to the enforcement of a quality policy are in the hands of the plant Quality Control staff, it is extremely important that it be constituted of the strongest statistical and technical talent available, and that it be assigned requisite resources and authority.

Central Staff Function

There is a need for a small group of Q-C people in a multi-plant organization who can coordinate quality problems which arise between plants, review specifications for their over-all consistency, and serve as a source of consultation

. . . Continued on page 16

NEW from DELTA

20" metal-wood *variable speed* BAND SAW

No matter what your cutting requirements —in the foundry, toolroom or pattern shop —this all-new Delta 20" Metal-Wood Band Saw gives you real on-the-job performance. Now—*for less than $900.00*—you can have the features you said you wanted most for greater accuracy and better cutting:

WIDE RANGE VARIABLE SPEED DRIVE... gives you a tremendous speed range—50 to 4500 FPM—for cutting everything from stainless steel to aluminum, wood and plastics. This versatility can't be equalled.

SCIENTIFICALLY DESIGNED BLADE GUIDES... ideal for heavy metal cutting because they furnish more "close up" blade support than conventional type guides. These new Delta blade guides are the key to better accuracy, straighter cuts, and longer blade life.

RUGGED FRAME CONSTRUCTION... features a massive, rigid internal frame with a modern fabricated exterior. Exclusive 3-point adjustability (wheels, upper guide and table) assures perfect alignment of key components.

In addition to these outstanding features you get a massive table with double trunnion support, convenient speed controls, plus built in chip blower *at no extra cost.*

SEE IT AT YOUR NEAREST DELTA DEALER— he's listed under "TOOLS" in the Yellow Pages—or write: Rockwell Manufacturing Company, Delta Power Tool Division, 622A N. Lexington Ave., Pittsburgh 8, Pa.

BLADE WELDER, including shear and grinder, shown on No. 28-462. Bracket mounted on 20" Band Saw for machine-side use. (Optional accessories)

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

CIRCLE INFORM-A-GRAM KEY NO. 15

interchangeable with all standard JIC cylinders

With the introduction of the ALL NEW T-J Squair Head, Tomkins-Johnson now offers industry the most complete design range of air and hydraulic cylinders. Presently available in bore diameters from 1-½ to 8 inches, the T-J Squair Head is an interchangeable cylinder which produces maximum force and efficiency, with minimum pressures . . . and is also adaptable to the use of low pressure oil as the working medium. Write today to The Tomkins-Johnson Co., Jackson, Michigan, for Bulletin #SQ 10-58 and complete details.

CHECK THESE 10 POINTS OF T-J SUPERIORITY

1. One Piece Piston
2. Hard Chrome Cylinder Bore and Piston Rods
3. High Tensile Steel Tie-Rods
4. Cushion Adjusting Screw, Externally Adjustable
5. New Super-Cushion for air, or Self-Aligning Master Seal for oil (T-J Patents)
6. Solid Steel Heads and Mounting Plates Standard all Models
7. Port Design Allows Minimum Pressure Drop on Inlet or Outlet
8. Chevron Type, Self-Adjusting Rod Packing
9. Piloted Packing Gland—Absolute Alignment
10. Piston Rod, Extra Strong—Polished and Chrome Plated for Efficiency and Protection

T-J TOMKINS-JOHNSON
RIVITORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

CIRCLE INFORM-A-GRAM KEY NO. 16

. . . Month's Talk from page 14

on the infrequent or unusually difficult statistical problems which over-tax the plant Quality Control people. This group can also assist in the interchange of ideas within and without the company and make widely available new ideas or techniques as they come along.

Central Q-C is a logical place for the coordination of the use of high speed computing of engineering or scientific problems because of the complexity of preparation of the data. For this reason, this group may be expected to be most familiar with the more complex statistical techniques and to be in a position to assist the plants. In general, they will also have broader experience in industry and be able to bring those experiences to bear on company problems.

A central Q-C Laboratory may be equipped for standardization of measurements, for the study and development of instrumental techniques, for many types of experiments involving sampling and measurement, and for quality assessment testing. Their quality audit will be much more infrequent than that conducted by the plants. It should be aimed particularly at a cross-comparison of the long-term level and uniformity of quality of similar products made in different plants and closely matching products made by competitors.

The aim of the whole Quality Control organization should be to make the best possible use of scientific statistical tools. More important is the task of awakening the quality consciousness of the company, to develop current sources of information on the status of quality, particularly of impending change, to apply keener analytical tools on a more concerted and continuous basis, and to open more channels of communication for feed-back of information required for intelligent supervisory action. end

BUY
U.S. SAVINGS BONDS
TODAY

GOOD NEWS FOR COST MINDED TOOL ENGINEERS

STANDARDIZED UNIVERSAL INDEX PLUNGERS COST 75% LESS THAN SPECIALLY-MADE TOOL ROOM PLUNGERS

In jig or fixture manufacture, it's both expensive and time-consuming to design and machine special index plungers for multi-station tools. To save time and money use Universal Straight or Taper Plungers. They are made in standard sizes . . . come complete, ready for installation . . . at approximately ¼ the cost of specially made tool room plungers. Universal Index Plungers can be assembled from either top or bottom and can be removed in either direction. Because the Universal plunger body and bushing have the same standard diameter . . . all holes can be bored with the same tool, simplifying drilling of jig or fixture in fabrication.

Universal Index Plungers can be actuated by either hand lever or air cylinders for automatic indexing tools. The locating bushing, plunger and plunger bushing are hardened and ground . . . precision built for extreme accuracy and long wear. Write for catalog detailing plungers plus other Universal production tools.

OTHER PRECISION-BUILT COST-SAVING UNIVERSAL PRODUCTION TOOLS

211

Floating Chuck

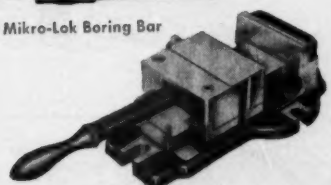
Standard Collet Chuck

Mikro-Lok Boring Bar

Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing

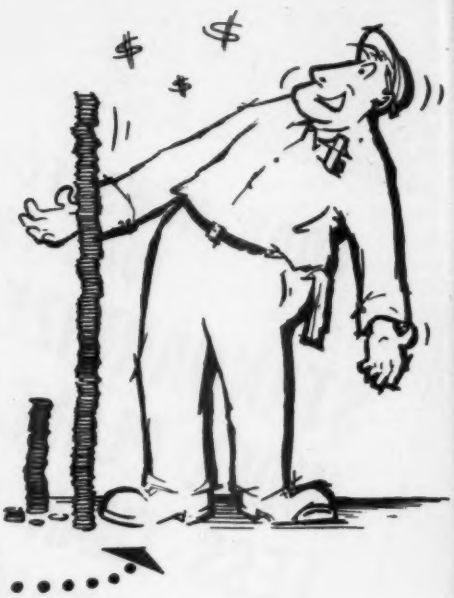


Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 8, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 17

Six Ways to Save... ON ALUMINUM BRONZE WEAR STRIPS AND WEAR PLATES



MEET JACK: *A ficticious character we have chosen to illustrate a non-ficticious story*

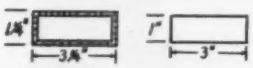
LENGTH

Jack needed 4 rectangular wear strips, each 36" long. Always before, he ordered 8 castings, each 18" long and had to splice them together. NOW . . . Jack has found out about MEIER WEARITE EXTRUDED ALUMINUM BRONZE RECTANGLES and how it comes in any length up to 10 feet long, so he specifies the exact length.

AVAILABILITY

Jack used to have to wait 2 or 3 days for castings, since that is the usual required time to have them made up. Now Jack orders Wearite and gets it right off the shelf of the local distributor, which saves him time.

SIZE (On a 1X3 wear plate, for example)



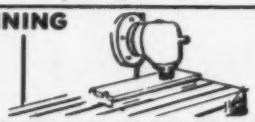
CASTING 13.4¢/FT. WEARITE 9.8¢/FT.

There was a time when Jack would have to order his castings oversize and machine them down to the required size. Jack did this to get rid of the sand inclusion which was around the surface. "Why wear out good cutting tools to remove excess scrap" Jack reasons. "With Meier Wearite little or no 'cleanup' work is required, and I can choose from *94 different sizes* of stock."

QUALITY

Jack has found out since he has switched to Wearite that the new metal is a "quality" metal. WEARITE EXTRUDED RECTANGLES are produced from semi-continuous cast billets under the strictest of laboratory control. This makes them tough and longer lasting.

MACHINING



When machining is required, Jack has found that he prefers the Wearite to castings. Extruded metals are free from porosity and have a homogenous structure; this makes Wearite easier to machine.

COST

But what makes Jack really happy . . . REALLY, REALLY happy . . . is that besides all of these advantages he has found that pound for pound of usable metal MEIER WEARITE EXTRUDED ALUMINUM BRONZE RECTANGLES COST LESS!

SEND FOR FREE CATALOG and SAMPLE TODAY

Meier BRASS & ALUMINUM Company

1471 E. NINE MILE RD., HAZEL PARK (DETROIT) MICH.

Distributor inquiries invited

CIRCLE INFORM-A-GRAM KEY NO. 18

LESS FRAME DEFLECTION CAN REPAY HALF THE COST OF YOUR O. B. I.

Is die life important on an O.B.I.? It certainly is! Die investment usually adds up to several times the cost of a press. Savings from just 15% or 20% improvement in die life is frequently enough to repay half your press cost.

This is why Danly O.B.I.s are built stronger, sturdier, to the industry's highest standards of rigidity. Danly O.B.I.s give you less frame deflection . . . more accurate die closure . . . longer die life . . . real savings in tooling costs! And other years-ahead design features, like Danly's exclusive low inertia air friction clutch, assure you of less downtime, lower maintenance costs, more dependable production.

Danly O.B.I. and gap frame presses have been setting remarkable performance records in the nation's largest press rooms for many years. Now this same Danly custom quality is available in a complete, standardized O.B.I. line, in capacities from 25 to 200 tons.

NEW CATALOG. For specifications and more facts, write today for your copy of the new Danly O.B.I. Press Catalog.

DANLY

DANLY

DANLY MACHINE SPECIALTIES, INC., 2100 S. Laramie Ave., Chicago 50, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 19

SPEED-BAND®
the newest concept in band saw blades—made from L-100-M, a double carbide alloy developed especially for band saws. Its hot hardness and abrasion resistance effect extraordinary results.

Available only from Capewell Distributors, of course

CAPEWELL

THE CAPEWELL MFG. CO.
HARTFORD 2, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 20

MANUFACTURING MEMOS

Data On-The-Spot . . . Although it's been a long time in coming, 1960 will find the ASM Metals Documentation Service ready to serve industry. The new electronic literature searching service will "literally save thousands of dollars for those needing specific information on metallurgical problems," says Allan Ray Putnam, managing director of the American Society for Metals.

Fast, Sure Checks . . . There's no chance for human error when Webber Gage's new, speedy electronic method for inspecting and recording gage block accuracies is on the job. Certificates show deviations from marked sizes of each block to the sixth decimal place and notes blocks too worn to be used. For details, write Webber Gage Co., 12900 Triskett Rd., Cleveland 11.

Specialized Plants . . . Beating the pull of gravity is the problem assigned to Standard Pressed Steel's new Exotic Metals Laboratory. The $100,000 operation is fabricating threaded beryllium parts for missile and satellite fasteners.

Weston Hydraulics, Ltd., subsidiary of Borg-Warner, recently consolidated its scattered operations in a new 100,000-sq-ft-plant in Van Nuys, Calif.

The first plant built for the exclusive processing of Du Pont Teflon, a popular plastic material, has just been opened by the Crane Packing Co. The 20,000-sq-ft-building houses complete molding and machining facilities.

Chromium Tubes . . . The first successful extrusion of pure chromium metal tubing was recently produced by Dr. James Wong of Nuclear Metals, Inc. After much experimentation, Union Carbide Metals Co.'s laboratory grade chromium powder was extruded into tubing with almost the same density of pure chromium metal.

New Officers . . . Taking over at the helm of the American Machine Tool Distributors' Association for 1960 are J. Russell Clark, president; George E. Merryweather, vice president; I. B. Rabel, second vice president; and C. D. Day, secretary-treasurer.

Carl J. Demrick, president of Amplex Division, Chrysler Corp., was recently elected president of Powdered Metallurgy Parts Manufacturers Association.

CIRCLE INFORM-A-GRAM KEY NO. 21 →

HAVE YOU CHECKED THESE FACTS ON GUN DRILLING?

The Most Economical Gun Drilling Machine on the Market.

Utilizes the Full Potential of Modern Rotating Gun Drills.

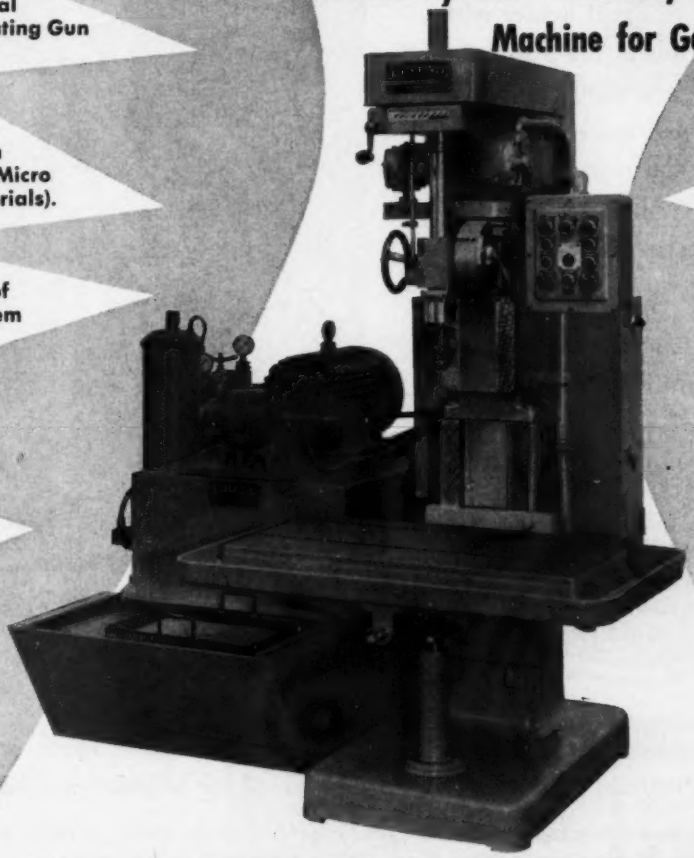
Deep, Accurate Holes with Fine Finish (2 to 32 Micro inches in most materials).

Easy Drilling of Difficult Problem Holes.

Ability to Pre-cision Drill Odd Shaped Pieces.

EDLUND

Gun Drilling Machine Model 2G and High Pressure Coolant System — The only Vertical Gun Drilling Machine for General Purpose Work.



Accurate Drilling of All Types of Material — Aluminum, Cast Iron, Brass, Tool Steel, Stainless, and other Steels.

Can Eliminate Second Operations — Reaming, Grinding, and Honing.

Write for descriptive Bulletin 2G or contact the EDLUND Representative in your area for complete information on the Vertical Gun Drilling Machine and Coolant System.

SPECIAL CONTRACT JOB WORK FOR GUN DRILLING CAN BE ARRANGED WITH EDLUND. SEND PART, BLUEPRINT AND REQUIREMENTS.

EDLUND REPRESENTATIVES IN MAJOR CITIES

EDLUND

MACHINERY COMPANY Cortland, New York

Division of Harsco Corporation

YESTERDAY'S PIONEER . . . TODAY'S LEADER

WELDON / HEAVY DUTY END MILLS AND HOLDERS

(BOTH ARE STOCK ITEMS)

● Look at this rugged 2″ diameter Weldon end mill with 4″ long flutes which made a 2½″ deep cut in a solid block of 4140 die steel—heat treated to 260 Brinell.

This HEAVY DUTY Weldon end mill is held by an end mill holder which bolts securely on to the nose of the milling machine spindle. The holder is driven by two drive keys on the spindle nose. The 2″ diameter shanks of these heavy-duty end mills are securely held by two large hollow head screws.

For top performance and sturdy long life in end mills—large or small—look to Weldon.

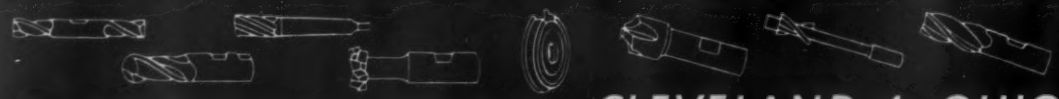
SEND FOR LATEST CATALOG NO. 11

Catalog list numbers are now marked on all Weldon tools and holders as an aid when reordering . . . another WELDON FIRST.

Weldon distributors throughout U. S. A. and Canada carry complete stocks to serve you.

HD4

THE WELDON TOOL COMPANY



3000 WOODHILL ROAD · · · CLEVELAND 4, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 22

MANUFACTURING MEMOS

New Line

Detroit Broach & Machine Co. recently unveiled a new line of high production presses that perform simple or complex broaching, assembly, or straightening operations.

Acquisitions

Magnaflux Corp. is now operating as a subsidiary of General Mills, Inc.

Houdaille Industries, Inc. recently acquired Calmore-Buffalo, Inc., manufacturers of automatic screw feeding devices.

Another step in the western expansion of H. K. Porter Co., Inc., is the addition of Hill Transformer Corp. to its operating plants.

Henry P. Boggis has sold his business to Henry P. Boggis Co., a new corporation with Donald M. Pattison, formerly with Motch & Merryweather, as president and principal stockholder.

Plan Ahead . . .

Jan. 12-15. Society of Plastics Engineers, Inc.'s Annual Technical Conference, Conrad Hilton Hotel, Chicago.

Jan. 15. Malleable Founders Society's Semi-Annual Meeting, Hotel Sheraton-Cleveland, Cleveland.

1960 High Spots

April 25-29. Compressed Air & Hydraulics Exhibition, London, England.

April 21-29. Tool Show, Detroit.

April 25-29. Welding Show, Los Angeles.

May 9-13. Metals Show, Dallas.

May 11-13. Material Handling Show, Los Angeles.

May 23-26. Design Engineering Show, New York.

Sept. 6-16. Production Engineering Show, Chicago.

Sept. 6-16. Machine Tool Builders' Show, Chicago.

Sept. 7-15. Machinery Show, Chicago.

Nov. 14-18. ASTE's Western Tool Show, Los Angeles.

PRECISION PRODUCTION PROBLEMS ?

Here's help from Bausch & Lomb

in TOOL DESIGN
INSPECTION
FABRICATION
MEASURING
TESTING

NEW! ALIGNMENT INTERFEROMETER

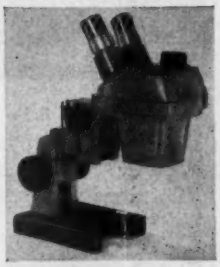
Accurately measures small changes in angle over a range of 30 seconds of arc (±15 seconds). Easy direct scale readings to 0.2 seconds (0.000006″).

BENCH COMPARATOR

Exclusive understage illumination—no complex set-ups, no holding fixtures for most work. Magnified silhouettes show errors instantly. Reads to 0.0001″ with optional micrometer stage.

STEREO-MICROSCOPES

Magnified 3-D views of tiny parts. Dustproof, shockproof, can be mounted right in machine or fixture. Speeds assembly, inspection. Most complete line, widest field of view.

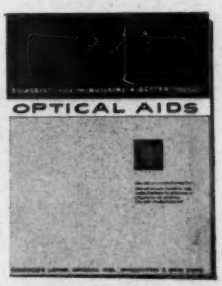


DR-25 OPTICAL GAGE

Direct scale reading to 0.0001″ . . . 0″ to 3″ range without gage blocks . . . accurate to 0.000025″. See precise measurements at a glance.

OPTICAL AIDS CATALOG

Time-and-money-saving data on Surface Comparators, Industrial Magnifiers, Macroscopes, Microscope Bodies, Micrometer Discs, Wide Field Tubes, Brinell Microscopes, Shop Microscopes.



NEW TOOLMAKER'S MEASURING MICROSCOPE

Quickly measures opaque or transparent objects of any contour. Linear, accurate to 0.0001″; angular, to 1 minute of arc.

MAIL COUPON TODAY FOR VALUABLE DATA

BAUSCH & LOMB OPTICAL CO.
77301 Bausch St., Rochester 2, N. Y.

Please send literature on optical production aids checked below:

☐ Alignment Interferometer ☐ Bench Comparator ☐ Toolmaker's Microscope ☐ Stereomicroscopes ☐ Optical Aids Catalog ☐ DR-25 Optical Gage

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CITY ..... ZONE ..... STATE .....

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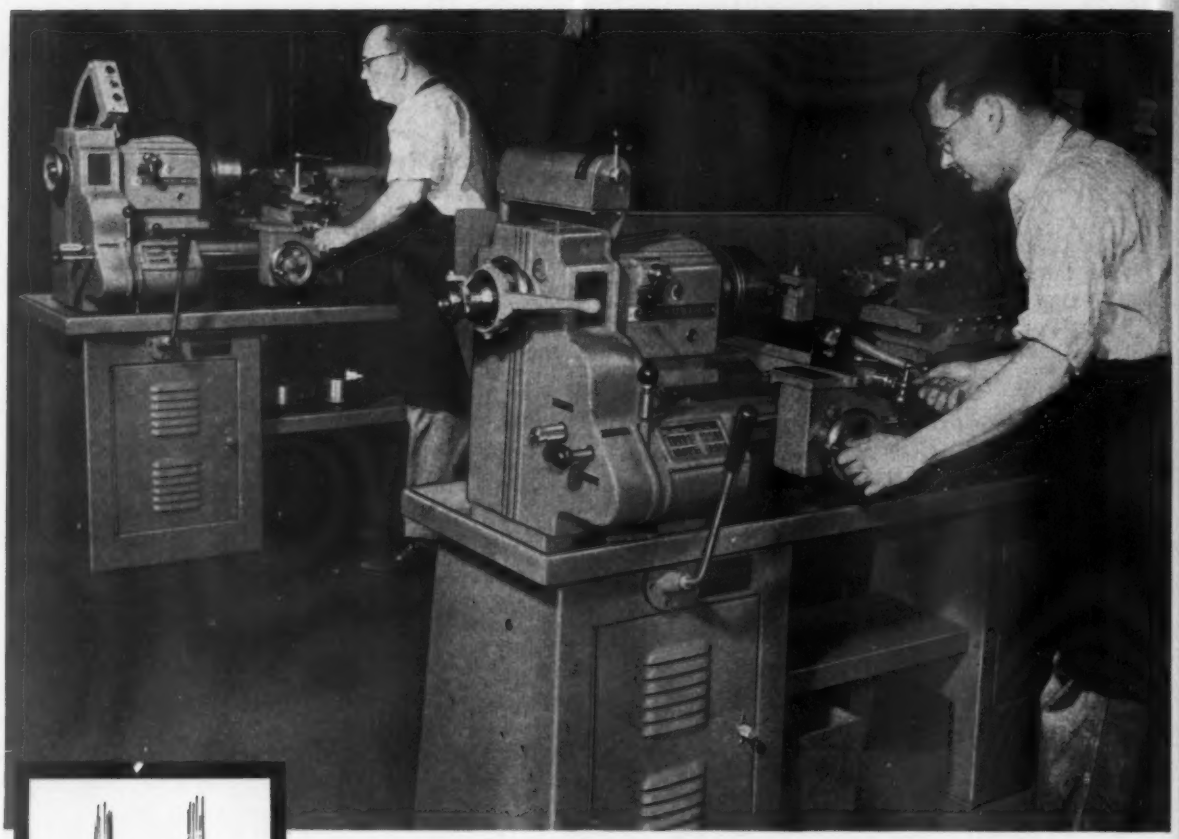
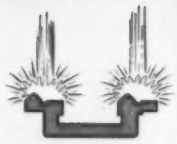
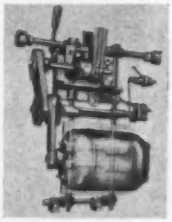




Flame hardened bed ways — a long-service-life feature that is standard equipment at no extra cost.



Note the heavy-duty construction of the 10-speed countershaft — the six ball bearings for smoothness and long service.

Enclosed headstock provides greater rigidity, safety . . . longer service-life. Shaved gears, shafts, bearings travel in a pumped bath of oil.

"Clausing lathes really pay their way"

HERE'S PROOF OF PERFORMANCE: *"We wouldn't be without our Clausing 12¾" lathes. They're easy to set up and operate. And we especially like their heavy construction which enables us to take deeper cuts, and hold tolerances on repetitive operations. They really pay their way."*

Uehling Instrument Company
Paterson, New Jersey

This report is typical. Clausing lathes *do* lead their field in Precision, Production, Efficiency and Value. Here are a few reasons why:

- **Headstock, quick-change box and apron are totally enclosed . . . *gears and shafts run in bath of oil***
- **Heavier thoughout — "have more guts than most of our machines costing 3 or 4 times as much"**
- **Flame hardened bed ways**
- **Forged steel spindle, with hardened, ground L-00 nose**
- **"Zero Precision" Timken tapered roller bearings**
- **Verified precision — factory test report accompanies each lathe**
- **Choice of heavy-duty variable speed or 10-speed countershaft**

See Clausing . . . check, feature for feature, dollar for dollar . . . before you buy *any* lathe of comparable size. See for yourself why Clausing is acclaimed *the* outstanding lathe value.

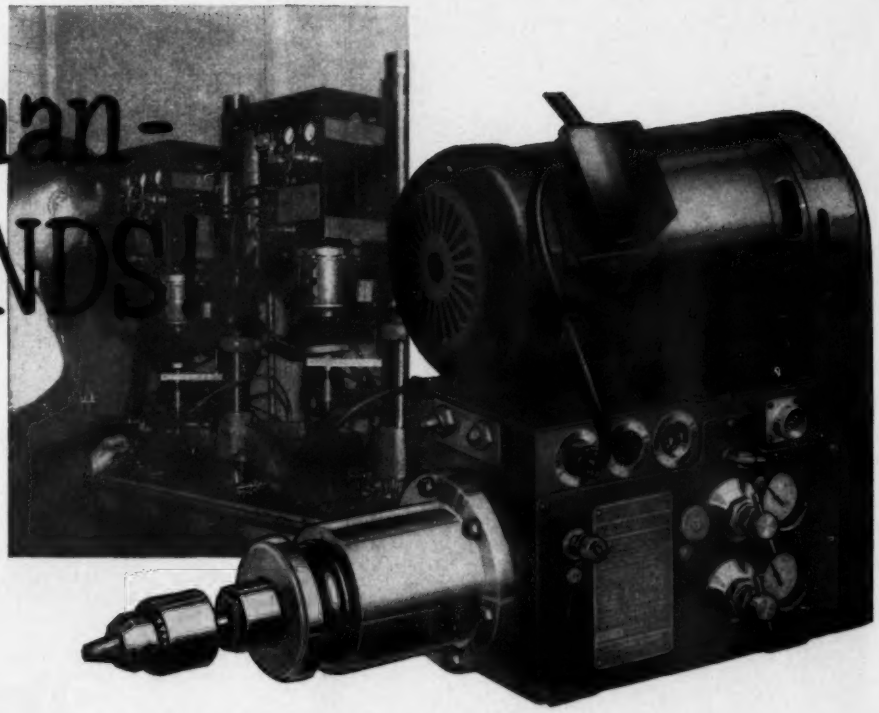
Write today far catalog and name of nearest dealer.

CLAUSING

CLAUSING DIVISION
ATLAS PRESS DIVISION
1-115 N. PITCHER ST. • KALAMAZOO, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 24

look man- NO HANDS!



DRILL PRESSES BECOME AUTOMATIC

with...

DUMORE AUTOMATIC DRILLING UNITS

do all these jobs, and more . . .
TAP • DRILL • REAM • CHAMFER
SPOT-FACE • CENTER • DE-BURR
even in stainless steel

COMPLETELY AUTOMATIC . . . just plug in and they're ready to go . . . all controls built in. Unskilled labor can learn to operate in minutes. Actuation by foot switch leaves both hands free for parts loading, positioning, unloading.

Once set, they're always set with no operator fatigue, slowdowns, or errors—minimizing scrap loss and tool breakage—resulting in lower cost, increased production. Easy, quick control adjustments for fast change-overs from job to job, long or short runs. Capacity from #60 to ⅜" for drilling, or #0-80 to ½"-20 tapping in steel. Automatic woodpeckering control available for chip removal in deep holes. Multiple spindle heads fit on nose of basic unit for simultaneous multi-hole work.

TRY ONE NOW . . .

on your own drill press column, or ours . . . and see the wonderful proof of performance.

ASK YOUR LOCAL DUMORE INDUSTRIAL SUPPLY DISTRIBUTOR

for a demonstration, **now . . .** in your own shop if you like. 3 models to choose from, priced from $565.75, FOB Racine, complete with all components including motor, ready to operate. Factory trained field service and application advice, of course. Complete line of accessories, too!

Want more information? -- **SEND COUPON**

You Can Do More with **DUMORE**® All-Purpose Precision Metalworking Tools

THE DUMORE COMPANY • 1304 Seventeenth St., Racine, Wisconsin

Versa Mil • Drill-N-Tap Units • Drilling Units • Drill Heads
Micro-Drills • Drill Grinders • Precision Grinders
Hand Grinders • Flex-Shaft Tools • Quills and Accessories

THE DUMORE COMPANY
1304 Seventeenth St., Racine Wisc.

Send me Single Drilling data ☐ catalog ☐

Name_____

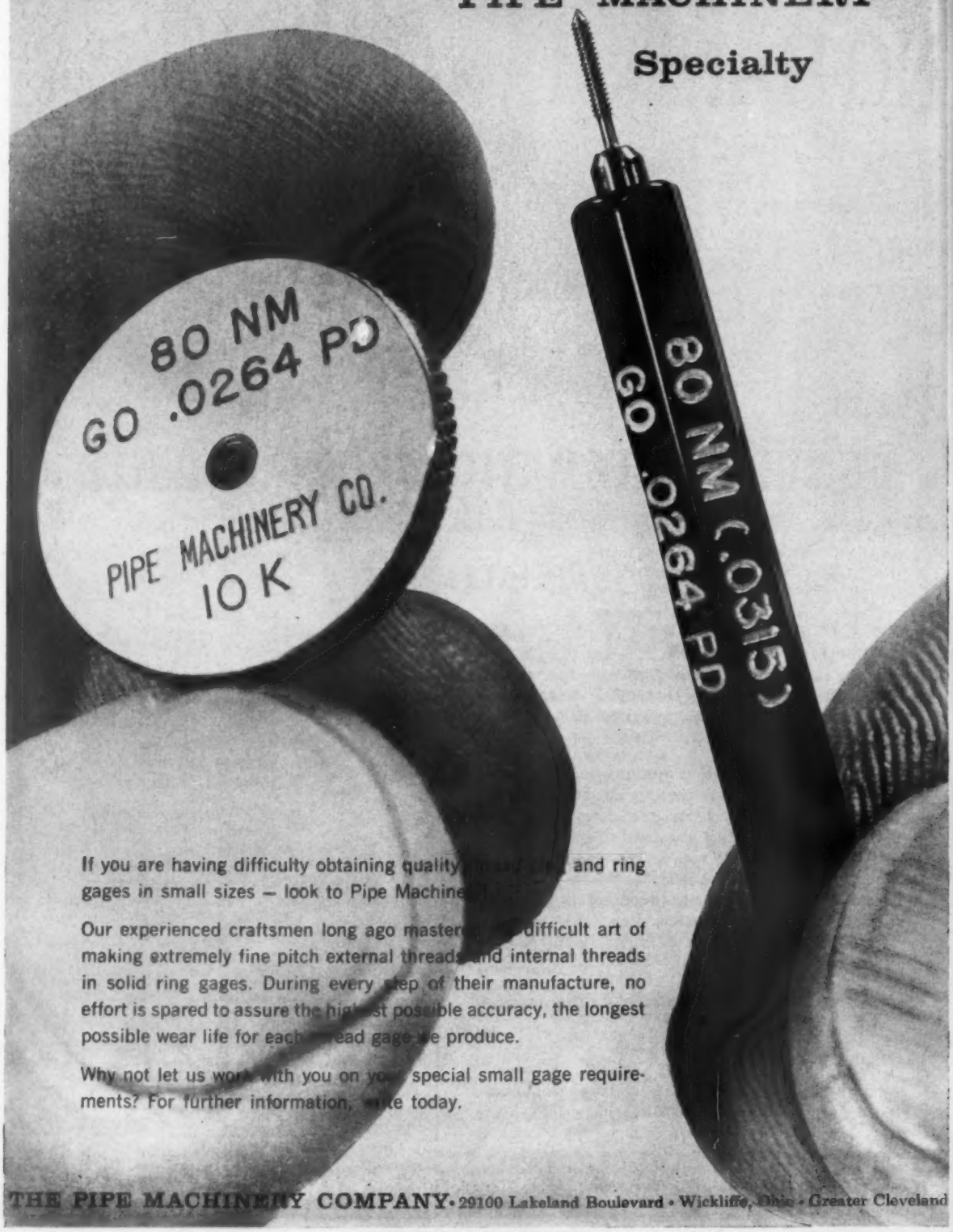
Company_____

Address_____

City_____ Zone____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 25

Small Thread Gages are a PIPE MACHINERY Specialty



If you are having difficulty obtaining quality [illegible] and ring gages in small sizes — look to Pipe Machine[illegible]

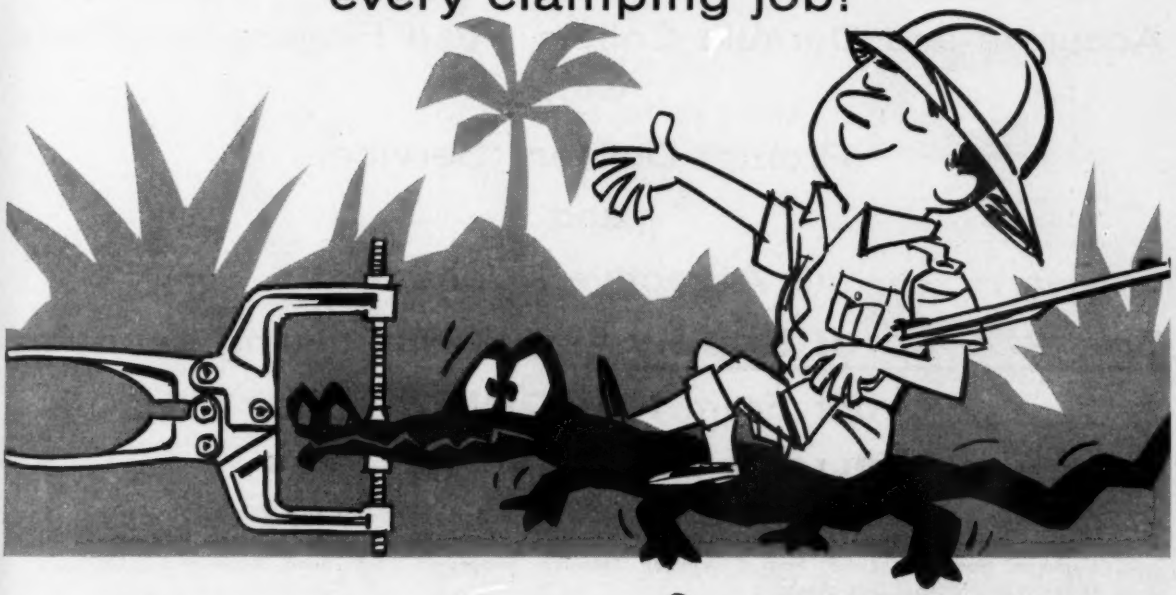
Our experienced craftsmen long ago master[illegible] difficult art of making extremely fine pitch external threads and internal threads in solid ring gages. During every step of their manufacture, no effort is spared to assure the highest possible accuracy, the longest possible wear life for each thread gage we produce.

Why not let us work with you on your special small gage requirements? For further information, write today.

THE PIPE MACHINERY COMPANY • 29100 Lakeland Boulevard • Wickliffe, Ohio • Greater Cleveland

CIRCLE INFORM-A-GRAM KEY NO. 26

There's a WESPO clamp or plier for every clamping job!



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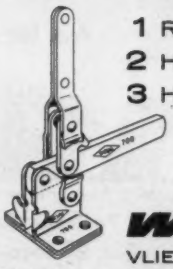

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CIRCLE INFORM-A-GRAM KEY NO. 28

ENDS SMASH-UPS

IN CASE OF PIN SEIZURE

SUPERIOR'S *Exclusive* REMOVABLE CAP PINS

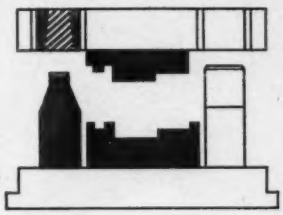
Now costly die set smash-ups can be avoided with Superior's removable cap pins.

In the event that foreign matter causes pin and bushing seizure . . . the socket screw pulls out of the retaining washer, then the matching taper of pin and cap act as a guide, preventing costly die damage as the punch holder is lowered by the press.

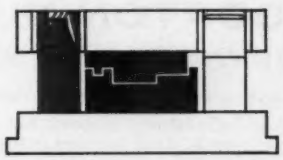
A new cap is merely substituted and the die set is ready for production. (Precision manufactured of removable cap pins permits interchangeability of caps.)

In addition, Removable Cap Guide Pins eliminate punch holder binding on guide posts when parting dies. The cap is removed from the pin merely by loosening a socket head screw which holds the cap in place. This frees the punch holder at the most critical point of the pin where it is apt to cock or bind.

Matching Taper and Cap act as guides prevent costly die damage



Note how cap tears loose in event of pin seizure other pin remains intact.



As punch holder is lowered in press, cap and pin act as guide. Replacing pin with a new cap puts die back into operation in minutes.

NOW on every Superior Die Set in diameters from 1½" upward at no additional cost.

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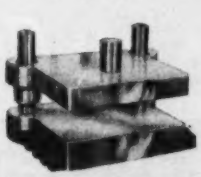
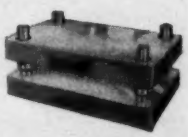
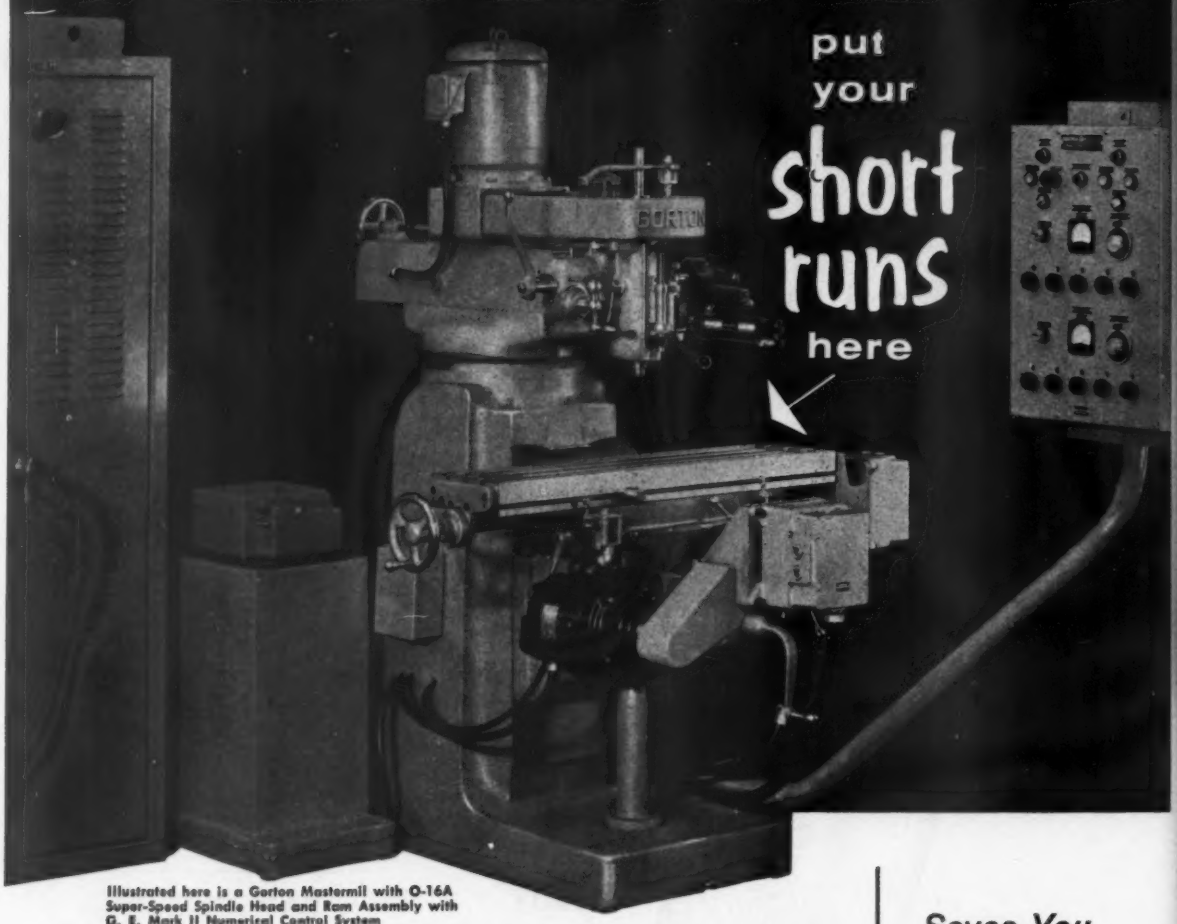




CIRCLE INFORM-A-GRAM KEY NO. 29

FOR NUMERICAL CONTROL AT LOWEST COST



Illustrated here is a Gorton Mastermil with O-16A Super-Speed Spindle Head and Ram Assembly with G. E. Mark II Numerical Control System

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is field tested and proved in use

This is how Gorton Numerical Control saves you money on short runs:

- — eliminates elaborate and costly tools, dies, jigs and fixtures
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- — making punched tape is simple typewriter operation

Punched tape . . . or magnetic tape control . . . is available to you on SIX standard Gorton machines and also on Gorton custom-designed machines. You'll be agreeably surprised when you learn the low cost of Gorton Numerical Control and how much more it gives you for your money. For full information write

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CIRCLE INFORM-A-GRAM KEY NO. 30

Simple...Positive...Faster...Accurate Indexing with TRIG-R-DEX

Trig-R-Dex is a completely new concept in manual indexing that simplifies and speeds straight or spiral operations.

To index—simply grasp the Trig-R-Dex handle, push down on the trigger button and move the handle until index pin engages the next hole, pull handle to stop position and you have indexed one increment. During work processing operations, the Trig-R-Dex handle always remains stationary. But, the index plate is keyed to the driver holding the work center . . . this assures the index plate, center and workpiece turn as a unit.

By selecting proper index plate, both right- and left-hand operations having from one to ten spaces can be accurately indexed. Changing from one index plate to another is extremely easy and takes but a couple minutes.

Because Trig-R-Dex is simple in design, of rugged construction, easy to operate and precision made, it will give years of accurate, trouble-free service while reducing costs and boosting your production.

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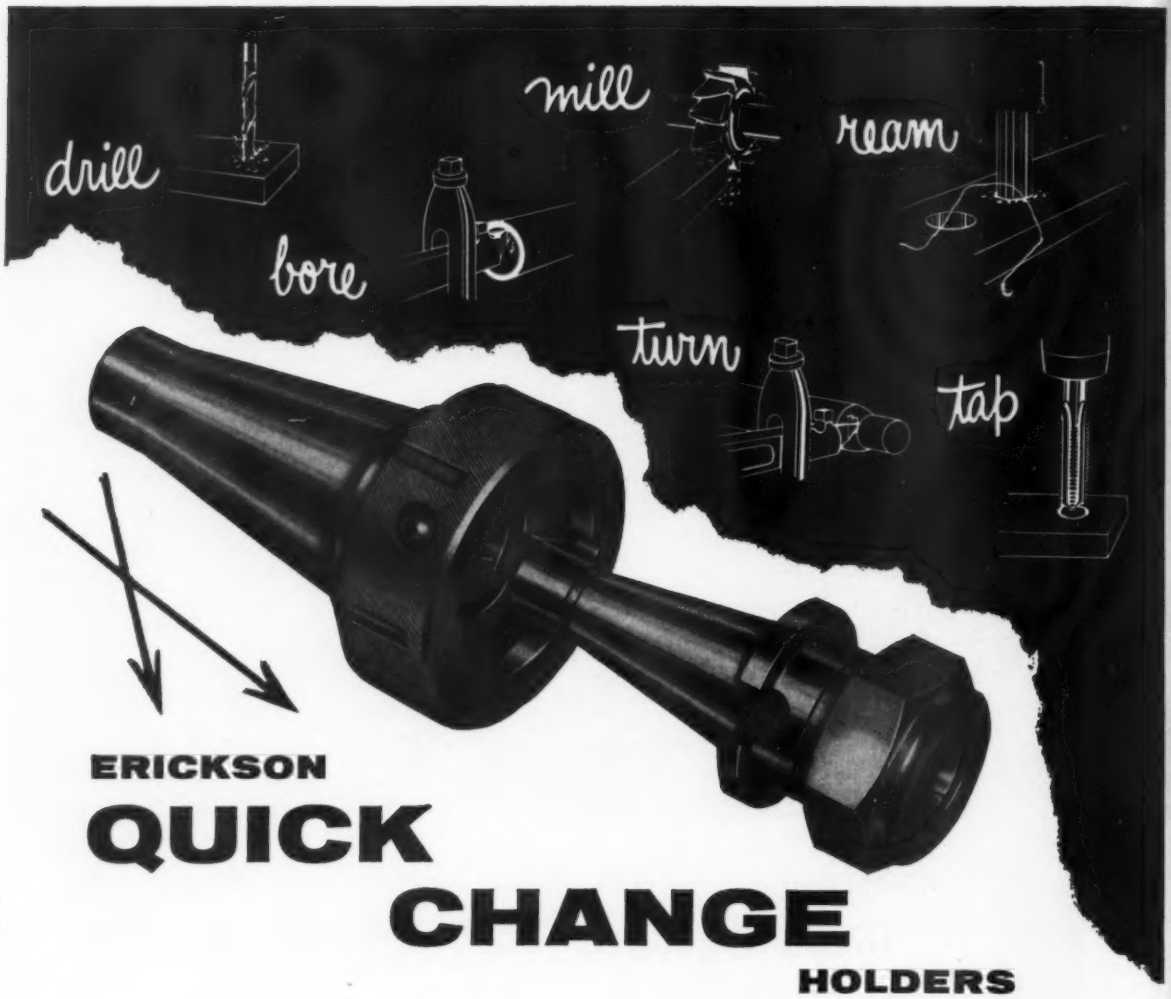

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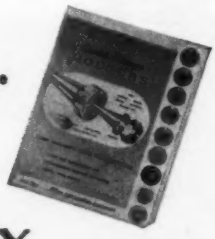
...for use with your standard MMS tapered tools
...designed for presetting of tools

Now you can use your present standard MMS tapered tools with the *new* Erickson Quick Change Holders. That means you get the double production advantage of Erickson's *high precision coupled with the rapid change feature.*

Several different models comprise the line: Morse taper holders for boring mills and radial drills, milling machine holders that fit standard spindle tapers, turret lathe holders that increase turret lathe tool-holding capacity, straight shank holders with #30 or #40 MMS socket. These holders take Erickson Collet Chuck milling machine adapters in both regular and heavy duty types, end mill adapters, shell and face mill adapters, Morse taper adapters, boring head adapters, and chuck adapters for Jacobs internal taper.

AA-7455

A call or card will bring the Erickson representative on the double. Meantime write for your copy of Catalog G "Erickson Quick Change Holders."



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EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES

CIRCLE INFORM-A-GRAM KEY NO. 32

FOREIGN COMPETITION vs OUR STANDARD OF LIVING

WHAT MIGHT BE most typical of our unprecedented standard of living? Consider the epidemic of screw-bally, albeit luxurious, and would-be-humorous gifts which have crept into our Christmas shopping channels — gifts which are pegged: "for the man who has everything!"

Only in a country where, figuratively, so many have virtually everything could such a fad or fancy take root, with entrepreneurs offering everything from mink draped chess queens to electronically heated toilet seats for cold bathrooms.

And so — in this land of the free enterpriser and the home of the brave spender — up another notch goes our standard of living. This may seem light and trivial, but still so typical.

Our standard of living is unprecedented on two counts: (a) compared to anything we've enjoyed heretofore, and (b) compared to the rest of the world.

We have been no modest, blushing violets about our standard of living. We've ballyhooed it from the house tops. We've told other nations, "if we can do it, you can do it, and if you need a few hundred million $ to get the ball rolling — here they are!"

In many countries, with and without our aid, the ball is really rolling. Their people are beginning to find out what emulating us does for their own standards of living.

Our standard of living has grown gradually and steadily from scratch — meaning the founding of our country. At no time have we ever been set back to a minus-zero point comparable to the chaotic devastation suffered by European areas and industries at the end of World War II.

In the few short years since, their operation bootstrap has been a wonder to behold. As they have whittled and chipped away at our markets their living standards have risen at an accelerating rate. Nothing succeeds like success. They have seen the light, and are on their way.

Mind you, these are friendly nations, but who see our markets as fair game, to the extent that we are now importing more than we export.

This portends the setting in of a great leveling-off process.

As the countries of the European Common Market (France, Italy, West Germany, Belgium, Holland and Luxembourg) and the Outer Seven (Britain, Sweden, Norway, Denmark, Portugal, Austria and Switzerland) adjust their tariffs to expedite mutual and world-wide trading, their living standards will rise to the detriment of ours. Why should this be?

What we have done, we have done while attaining and maintaining the highest rewards for labor in the world. As our markets — world and domestic — are invaded and sliced up by our foreign competitors we are destined to sell less and build less. How, then, can industry continue to support labor in the style to which labor has become accustomed?

How can labor's demands for more and more cash take-home, fringe benefits, and shorter and less productive working hours result in anything but a lowered standard of living?

When, in the face of foreign competition, American industry, time after time, has to ring up "no sale" on the cash register, what's left for American labor? How can labor demand dollars which industry isn't getting? The answers are not easy, simple or pleasant.

Won't we, in turn, now have to emulate our foreign competitors, by designing, redesigning, producing and pricing our products to world markets and competition? We certainly can't say that we could never face up to a cycle of austerity such as the people of our foreign competitors have bootstrapped themselves out of. We might have to!

With other nations' productivity, market penetration and living standards having reached their present highs in only fifteen years of ballooning enterprise, what does that augur for us over the next fifteen years?

R. Harvey Whidden, vice president in charge of marketing of the Bulova Watch Company, recently said that the best way American industry can meet the challenge of foreign competition is to "go back to work," and that perhaps the American manufacturer is "not quite as good as he thinks he is."

In recognizing that, "A forceful well-planned effort is being made in Europe and elsewhere not only to penetrate our United States and Canadian markets but to dislodge us from Latin America, Asia and now, Africa," Industrial Designer Raymond Loewy warns, "Do not underestimate the gathering success of that effort. . . . Our state of plenty is 'nerve dulling.' We would do well to combine American techniques and experience with the qualities of toughmindedness demonstrated by Europe's best designers. This happy land is not the neat continental pasture it once was."

Just how great must the threat to our standard of living become before we "go back to work"?

E. Willard Pennington

Editor

ADJUSTABLE STROKE SAVES TOOLING

Now—put pressure where it's wanted instantly and cheaply—with Mead's powerful midget air cylinders (1" bore, single-acting, spring return). Stroke is adjustable to exact length required, even after components are locked in place. Use them singly or in groups to move, hold, press or eject small work pieces; to close and open large jigs, forms, fixtures. Actually they will replace human fingers and mechanical clamps in innumerable routine jobs.

NEW MIDGET AIR CLAMPS

(SPRING RETURN AIR CYLINDERS)

NEW! SAVES TIME! These outstanding Air Clamp cylinders with adjustable strokes variable from ½" to 3" can be "tuned" to exact length wanted even *after* setup is made! This feature alone saves hours of time designing, laying out special jigs, fixtures. **NEW! SAVES AIR!** You can conserve air in large fixtures (where dozens or hundreds of Midget Air Clamp cylinders are used) by using "just enough—no more" stroke. The shorter the stroke, the faster the cycle. **NEW! SAVE SPACE & MONEY!** The cylinder "nose" telescopes into barrel reducing stroke and overall length. All this at prices so low you can almost *forget* their modest first-cost. But you'll *remember* the countless man-hours saved—the lessened fatigue of your workers at monotonous jobs—the improved quality and accuracy of their work!

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PATHFINDER IN AIR POWER AUTOMATION

CIRCLE INFORM-A-GRAM KEY NO. 34

Common Sense and Tape Control

by Clarke Redfield

DID YOU LOSE AN ORDER RECENTLY? One of those nice gravy jobs that comes along regularly? But then your underground finds out your competitor's price and you quickly realize that he has made a mistake in his cost estimating. He could not set up his first piece for this price; he will lose his shirt; you will be back in there the next time. Don't be so smug and complacent! You may have just now met Tape Control for the first time — and the hard way!

Don't press the panic button! The first impulse is to become Tape Control-equipped, and as fast as possible. Mortgage the old homestead if necessary! This could be disastrous. If you ever needed common sense, good advice and clear thinking, you need it now. There are so many facets to this problem, you must be extremely careful and methodical in your thinking.

So many separate and distinct specifications are involved — yet all so interrelated — that you must set up a schedule of factors on which you must make decisions.

As a basic breakdown, there are point-to-point and continuous path systems. We instrument makers are primarily interested in point to point, discrete positioning systems. Do we need, in addition, polar positioning? Each must answer for himself. The air frame builder on the other hand, needs continuous path equipment. Consider your product, your average type of work, your potential market.

Here again we have two choices: Linear measuring systems and turns counting systems. What degree of accuracy do you need? The measuring system will cost more, but will retain a higher degree of accuracy over a longer life. The turns counting system will gradually deteriorate as screws and slides undergo wear.

One of the standard answers to this question is, "Oh, just simple standard components, relays, etc." But, if there are a thousand (or more) relays involved, it will take a lot of time to find which one has the dirty, intermittent contacts which are causing all the trouble. With such a large investment, you can't stand a lot of downtime. Where will your service come from? Locally or half-way across the country?

Tape Control can be applied to almost any machine. It is generally possible to decide on the control system and the machine more or less separately. But they must be coordinated. Don't select a sophisticated super-accurate control system and then apply it to an inferior machine. The reverse is equally foolish. Remember — common sense.

Look for seemingly little things. Does the system you are considering have zero reference shift? This is a real time saver. Does the continuous path system provide for changes in cutter size? Does it provide for mirror images? Does it use the standard eight channel tape? Listen to all the salesmen and make notes. Don't be "sold"; do your own buying.

Without mentioning names (although it has been rumored that Bendix makes a good one), there are a lot of good systems available. It seems unlikely that all can survive. Make sure that the one you select is backed by an organization that can be depended upon to give parts and service over the years.

Tape Control is expensive. You will realize large savings, but you still have to put out a lot of cash in the first place. Do you have four or five competitors locally doing the same general class of work that you do? Why not get together and buy your Tape Control cooperatively? Set it up as a separate entity and let each pay proportionately for the time used. Competitors, yes; but if each fights it alone, all may be sitting ducks more easily picked off by Tape Control.

In any case you must start thinking about Tape Control very seriously now. There has been a lot of talk about it in the papers and trade journals for some time. Have you wondered why more actual case histories haven't been detailed? Gentlemen, in some cases, savings have been so spectacular that publication of all the facts would have been an invitation to renegotiation!

Can you any longer ignore and postpone action on this kind of a potential? end

Mr. Redfield is Supervisor, Machine Tool Procurement, at Eclipse Pioneer Division of Bendix Aviation Corporation, Teterboro, New Jersey.

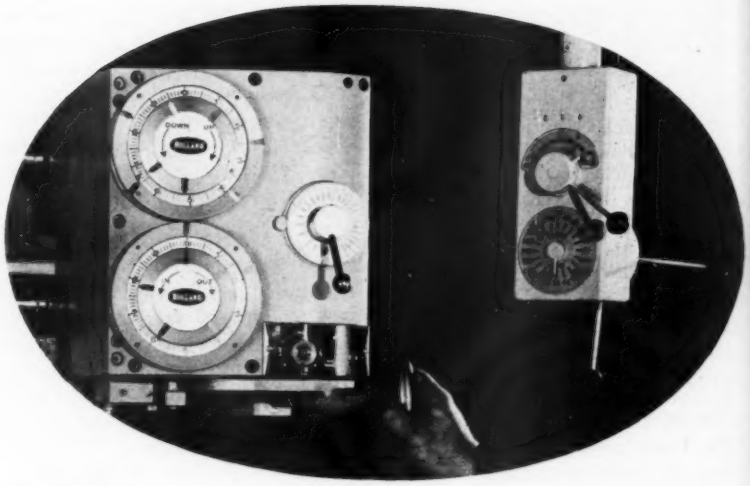


Fig. 1. Single lever controls all directional motions of the head, traverse and feed engagement. Table speed change, start, and stop are controlled from the pendant. Clock-type dials with dual pointers make exact head positioning possible without handwheels.

E. P. Bullard and his new fully-powered VTL

NO. 1 ON THE LIST of advances built into Bullard's new Dynatrol vertical turret lathe line is the single-lever control (Fig. 1) for positioning the heads and engaging or disengaging the tools from the work.

Second is the provision for feed rates directly coupled to table rpm, which are infinitely variable throughout the full range of the machine. With this, says E. P. Bullard, inventive force behind the new VTL, Dynatrol machines can be run at the optimum cutting rate for the kind of material and tool in use, at all times. Feed rate can be varied while cutting, without stopping the table.

Shown with the Dynatrol on the cover is Mr. Bullard, fourth president of the 80-year-old company and a creative engineer-inventor as well as top ranking business executive. He holds 39 machine tool patents, many of them on Bullard's Cutmaster and Manatrol VTL and their spacer table. A Yale and Harvard Business School graduate, he was assistant chief engineer, vice president in charge of manufacturing, and vice president and assistant general manager of Bullard Company before assuming his present position.

With the Dynatrol's single-lever control system and its visual indicators, the operator can move the heads to the proper position faster and with more confidence, can put the cutting tool closer to the work before engaging the feed, and can set the table in motion smoothly—all from one floor position. This means less time is spent getting the lathe ready to cut and more time is spent actually cutting.

The control for the smaller sizes (nine sizes are available, with 26" to 124" dia tables) is a horizontally swinging arm with a conveniently shaped pistol grip. Turning it changes the direction of the movement of the head (up, down, right, left, or at a 45° angle). With the grip pointed in the direction desired, the arm is swung to the left to actuate the head movement, which is infinitely variable, 0 to 9 sfpm.

When the head has been brought close to the work by the traverse motion, the feed is engaged by swinging the arm all the way to the right.

The larger machines use a remote control system based on the same operating principle. The operator regulates table movement, start, stop, or inching and selects speed from a control pendant. The speed selected is indicated by a light around a circular dial mounted at the right end of the cross rail.

The heads, in addition, are operated by a palm-size portable control box which has a pushbutton for starting or stopping the table, four buttons for selecting direction of head traverse, and a single lever for traversing the head and engaging the feed.

The Dynatrol's new concept in measuring utilizes large, easy to read, clock-type dials with dual pointers. The graduations and numerals remain stationary while the pointers rotate, one registering tenths, the other thousandths. In positioning the heads to the desired point, the operator can watch the movement of the pointers around the dial, rather than the tool moving toward the work. He can move the head rapidly at first, then slow it down and stop its traverse just as the pointers reach the proper reading on the circular dial.

In all sizes of the Dynatrol VTL, Bullard offers infinitely variable feed rates, indicated on a direct-reading dial. The rate of feed can be changed at any time during the cut without stopping the table—merely by rotating the feed-rate selector dial. This allows the feed rate to be matched exactly to the nature of the work and type of tool and to be adjusted while cutting to accommodate a change in stock-removal requirements or to allow for tool wear.

Many "hang-ons" are available to automate the Dynatrol, including Bullard's Man-Au-Trol or point-to-point or continuous path numerical control systems. end

How To Convert:

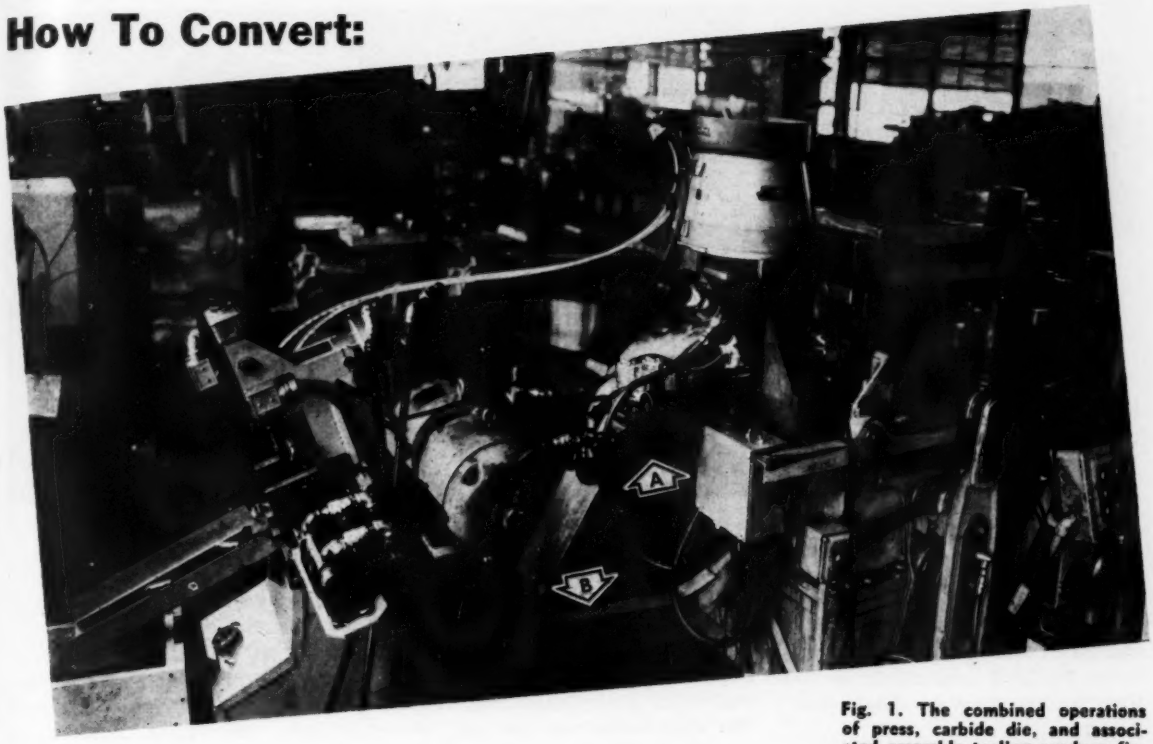


Fig. 1. The combined operations of press, carbide die, and associated assembly tooling produce finish-riveted stacks of small motor laminations. The field assemblies are delivered via chute "A." The strap laminations feed through chute "B" to the strap stacker and riveter at the left.

From Stamping Press to 'Production Department'

by E. Willard Pennington
Editor

TODAY, YOUR NEVER-ENDING STRUGGLE to attain manufacturing cost reductions has become, due to both domestic and foreign competition, a way of life. It exists throughout each and every one of the steps whereby a non-functioning piece of metal becomes a working component or finished product.

Cost-War Campaign

Your cost war starts with selection of material, choice of production method and equipment, devising of tooling, and ends with final assembly and packaging. Anywhere along the line that you can combine two or more operations, with a resultant decrease in manhours, you've saved pennies or dollars per operation.

The savings that you thus effect will both take some of the sting out of competition and add profit to your enterprise.

Currently, we have been watching the evolution of a press tooling program that represents the wrapping up of all the foregoing factors into a combined operations, manhour reducing, and final assembly project whereby a stamping press has become a "production department." This, in the same sense that Kearney & Trecker's new "Milwaukee-Matic" is becoming known as a tape controlled manufacturing machine, rather than as a machine tool with a built-in capability of performing any sequence of many diverse machining operations.

Manufacture by Press Tooling

Our story emanates from Eglinton Carbide Products, Inc., of Wyandotte, Michigan, specialists in the design and manufacture of carbide dies — and involves a carbide blanking die and associated tooling which they built for a high volume

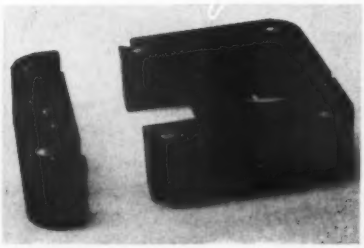


Fig. 2. A motor field and strap assembly as they come from the press "production department," automatically stacked to a height of 0.640", compressed, and riveted.

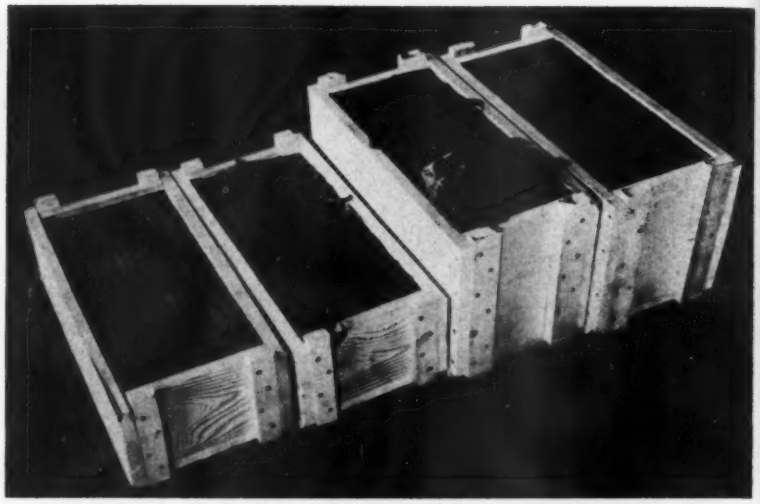


Fig. 3. Ordinarily, the motor laminations, as shown in the center two boxes, would be toted to the subsequent operations of counting, stacking, and riveting along another line. By this development, however, the Eglinton-designed-and-built carbide die and automatic stacking and riveting units enable the press to deliver the finished components shown in the extreme left and right boxes.

manufacturer of small electric motors.

The carbide blanking die is mounted in a 60-ton Henry & Wright high speed press and produces the motors' rotor laminations and laminated field assemblies. The H & W press actuates the carbide die and controls the associated tooling which stacks and rivets the field laminations so that they become finished motor components.

Thus the press becomes a production department, as shown in Figure 1, turning out the finished fields shown in Figure 2. The die alone could produce only the jumble of laminations posed in the center two boxes (field and strap laminations) of Figure 3, whereas our manufacturing press turns out the finished components shown in the extreme right and left boxes.

Blanking Operations Sequence

Referring again to Figure 1, the flow of material and operations is from right to left. Beyond the photo to the right are the Littell coil cradle and stock straightener. The coiled strip is 2½" wide and 0.025" thick, of 3½% silicon electric motor grade lamination stock. The abrasiveness of the high silicon steel demands a carbide die with its economy and capability of millions of blankings between grinds.

The strip stock is fed into the die by the H & W roll feed in increments corresponding to the die's station-to-station distance.

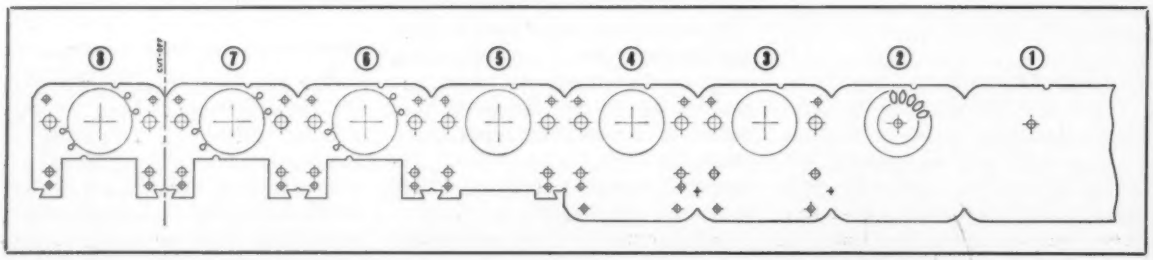
As the stock progresses through the carbide die, which is of the scrapless design, the operations performed are depicted in Figure 4 which shows the strip development and, Figure 5, the laminations as they are blanked from the strip and are freed to go, automatically, to the respective stacking and riveting functions of the "department."

The first blanking occurs at station #3 where the rotor is blanked through. The rotor laminations leave the H&W press and go to a separate line for loading onto the shafts and assembling into finished motor rotors.

In the finished electric motor, the gap between the revolving rotor and the field is critical as to both dimension and concentricity. Accordingly, at station #4, known as the air gap trim station, the rough hole from which the rotor stators were blanked (station #3) is struck by a carbide trim punch for exact size.

From station #5 the field "straps" are blanked through and transported via the chute, shown in Figure 1, to the strap stacking and riveting tooling at the extreme

Fig. 4. The progressive strip development though the eight stations of the carbide die. The coiled strip of electric lamination steel is 2½" wide. This width holds through station #4, with no carriers or edge scrap — hence the "scrapless" die designation.



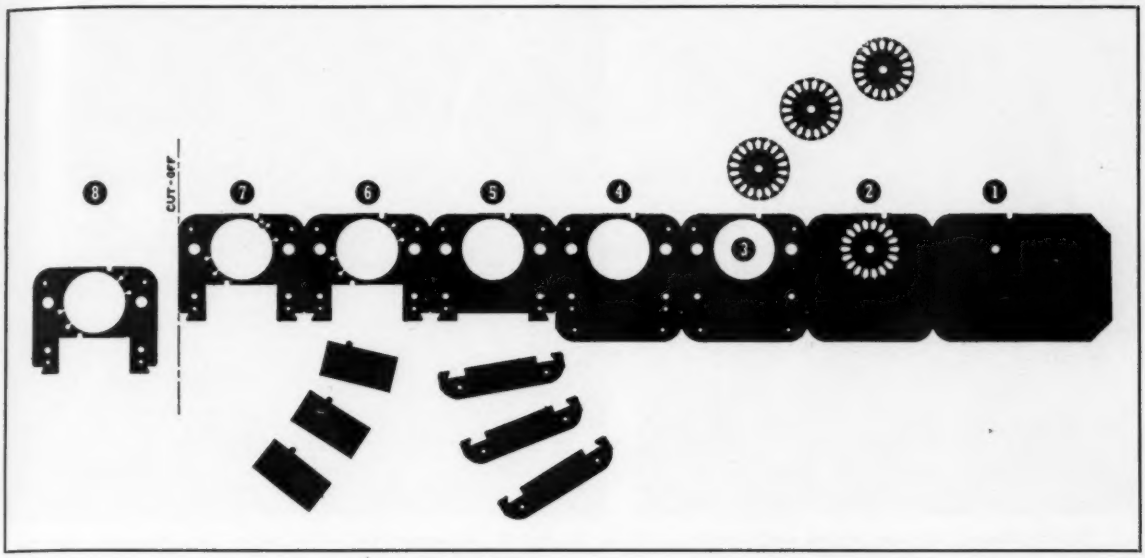


Fig. 5. A "play-by-play" schematic of the successive hits through the 8-station progressive die. #1, rotor shaft hole; #2, rotor cluster punches; #3, rotor blanked through; #4, air gap trim station; #5, strap is blanked through and feeds through chute "B," Fig. 1, to strap riveter; #6, removal of slug which provides clearance for coil winding around strap core; #7, idle; #8, cut-off, and where field blank is pushed down into die shoe for stacking and riveting.

left. The riveted strap laminations become the core around which is wound the motor's field winding. Therefore, at station #6 a rectangular slug is blanked out which leaves clearance for the coil winding in the field assembly. This slug is the only scrap from our scrapless die!

Following the idle station #7, at cut-off station #8 the field blank is sheared off and pushed down into the die shoe. This completes the blanking of rotor, strap, and field laminations from the 2½" wide coiled stock.

Stacking and Riveting Operations

It is from stations #5 and #8 that the special tooling comes into play which converts the H&W stamping press into our "production department."

The riveted strap laminations call for two rivets and the riveted field laminations require four rivets. The rivets are fed from a vibratory feeder, designed and built by the John W. Neumann Company. Automatically, this unit releases six rivets during each riveting cycle. Figure 6 shows the six translucent plastic tubes leading from the feeder to the six rivet hole locations. The rivets can be seen within the tubes.

In both cases, for straps and fields, the riveting units are fed laminations to a stack height or thickness of 0.640". The units align and compress the stacks preparatory to receiving and heading the rivets.

Strap Assemblies

From station #5 the strap laminations are impelled through the chute, shown in Figure 1, to the stacking and riveting unit, shown close up in Figure 7. The straps feed from the chute upward into the stacking and riveting fixture. When the fixture has accumulated a stack of laminations 0.640" in height, two rivets from the vibratory feeder tubes drop into the fastening holes.

The rivets are headed by the toggle-action ram driven by the Ortman-Miller air cylinder seen near the top rear of Figure 7. In the right foreground, another Ort-

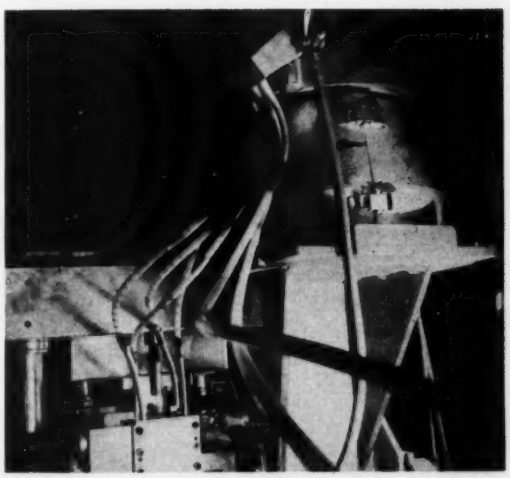


Fig. 6. The Neumann vibratory feeder delivers rivets to the two riveting units via six translucent plastic tubes—four tubes (background) leading to the field riveter, and two tubes (foreground) to the strap riveter.

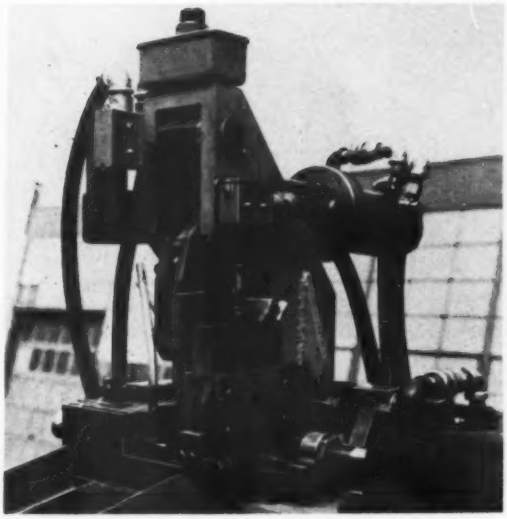


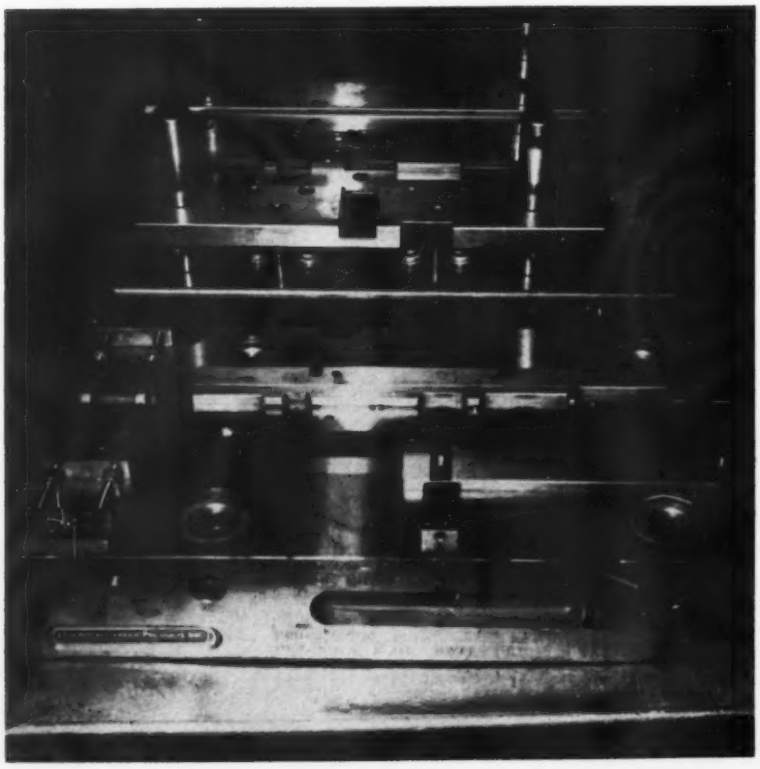
Fig. 7. Closeup of strap riveter which constitutes the end of the production line, Figure 1.

Fig. 8. The output end of the strap riveter showing two riveted strap assemblies headed down the delivery chute.

man-Miller air cylinder functions to align and compact the stack when it has attained its "count" of laminations 0.640″ high.

In the development of the automatic stacking and riveting functions of this special tooling it was found best to be controlled by the 0.640″ dimension rather than by a fixed number of laminations per stack. This was because of slight variations in stock thickness and any resultant accumulated error per stack.

A close-up view of the "output" end of the strap riveting unit is offered by Figure 8, showing two finished strap assemblies headed down the chute.



Field Assemblies

The upper and lower members of the carbide die are shown in Figure 9. The laminations for the field assemblies are sheared from the stack strip at cut-off or station #8 where they are pushed down into the die shoe. The mechanism showing on either side of station #8 (at the extreme left of Figure 9) constitutes a set of four spring fingers which retain the field laminations in the die shoe, thus preventing them from coming back to the surface of the die due to the blank pressure which will build up in the die.

Fig. 9. A view looking down on the 8-station progressive carbide die. The stations can readily be related to Figures 4 and 5. At the extreme left are the fingers which return the building up stack of field laminations so that the topmost one is always below the die surface.

For this entire succession of operations, the air valves, as supplied by Airco, are four-way solenoid operated units. The air line lubrication and pressure regulating system is supplied by Norgren and the electrical switches are standard Micro-Switch units and miniature General Electric Switchettes.

The carbide die is equipped with a mis-feed detector switch which functions to stop the press if the material does not feed into position properly. There are additional switches on the riveting units so that in the event there is a malfunction of either the field or strap riveting operation, the press will be stopped.

The field lamination riveting operation immediately follows cut-off and stacking of the laminations in the die shoe. A transfer cylinder conveys the stack of field laminations from under the die to the clamping and riveting unit which is mounted "outboard" on the bolster plate.

The field riveter, removed from the press, is shown in Figure 10, which also shows the four rivet feed tubes, and the cylinders which compress the 0.640″ stack and upset the four rivets. The unit as mounted at the end of the press and with a finish-riveted field being ejected is shown in Figure 11.

The chute which conveys the finished parts to boxes (Fig. 1) has been removed to show detail. The field riveter may be removed or installed in ten minutes. Further, it need not be disturbed when the die is removed from the press. This is also true of the strap riveter (Fig. 7). Both units are independent of the die so that they remain in place when the die is removed for sharpening.

A Production Department

When the shop whistle blows the strip feeds into the die. Once it reaches cut-off or station #8, one strap and one field lamination is produced with each stroke of the press.

The strap laminations from station #5 feed through the chute of Figure 1 to the strap riveter, and stack in the riveter to a height of 0.640″. Once the strap chute is fully "loaded" the stack "grows" one lamination per press stroke.

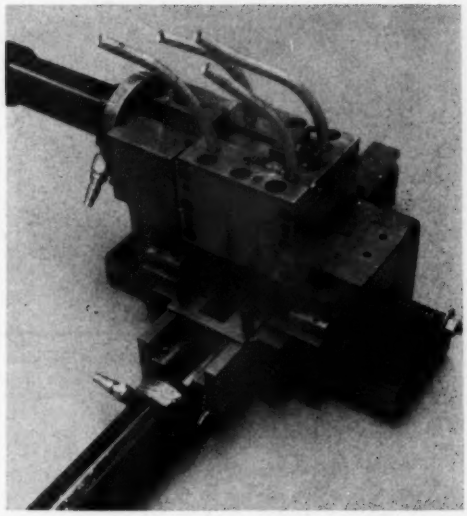


Fig. 10. The field lamination riveting unit, removed from its mounting position on the bolster plate. This shows the lower end of the four rivet feed tubes and the air cylinders which compress the stacked laminations and upset the four rivets.

Simultaneously, field laminations from cut-off or station #8 are building up to a height of 0.640″ in the die shoe preparatory to transfer to the field riveter. Automatically, when these stack heights are attained, the two stacks are clamped, rivets loaded, and headed, by the sequential controls which trigger the respective air cylinders.

The H&W high speed press is powered and controlled by a Reeves drive, with air-actuated clutch and water cooled braking. It, with its Eglinton carbide die and associated stacking and riveting units, is designed for an operating speed of from 185 to 200 spm. The press operation is continuous, there being no interruption of press speed during the lamination stacking and riveting operations.

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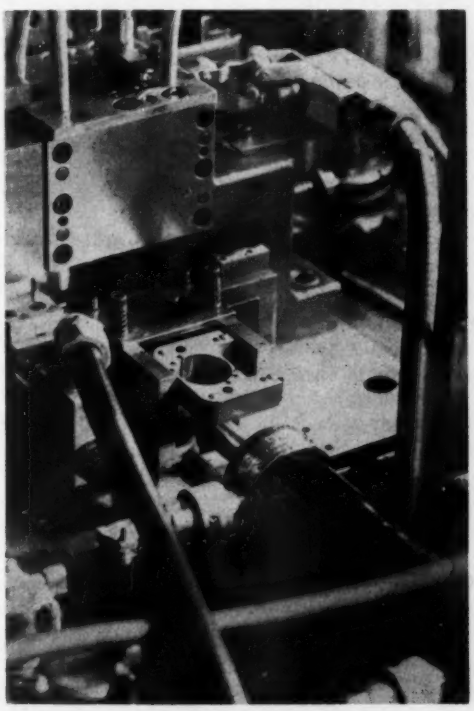

Fig. 11. The delivery end of the field riveter with a finish-riveted field assembly being ejected. The chute "A," Fig. 1, has been removed to show detail.

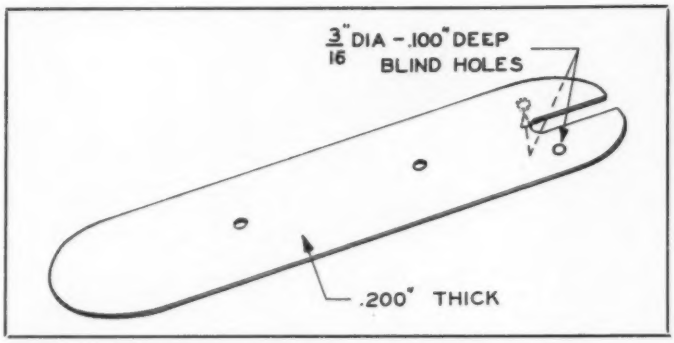

Fig. 1. The part, showing the 3/16" dia by 0.100" deep blind holes, which come in from opposite sides.

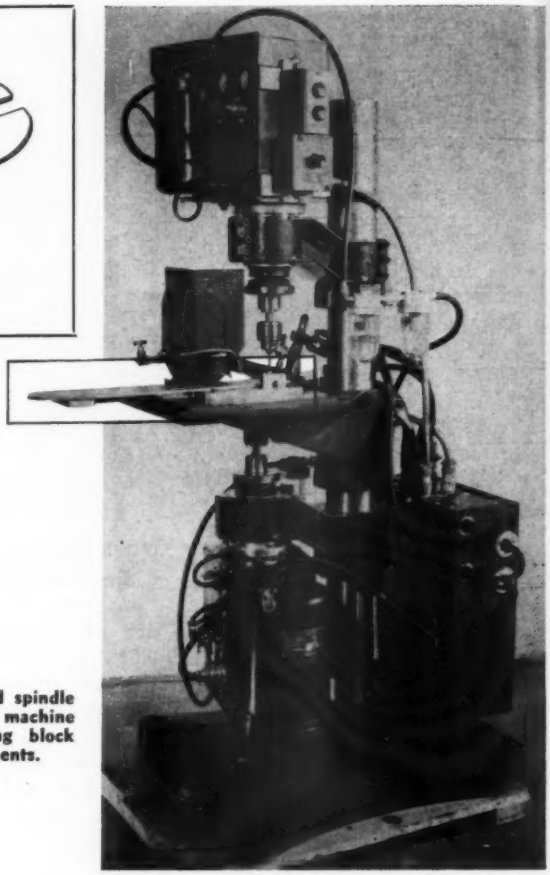

Fig. 2. An opposed spindle vertical drilling machine made from building block and plug-in components.

Not-So-Special, Special Machines . . . from 'BB' Components

"THIS JOB CALLS FOR A SPECIAL MACHINE—yes, that would be great—but I've a small operation here, what about the price? And, what if the job is cancelled? What would I do with it? Stick it out back in the alley or walk around it for years while it collects cobwebs? On the other hand, suppose everything good happens? 'Specials' still cost a lot of money, and, I'd have to wait a long time until it's designed and built. . . ."

Questions and doubts, but many of these can be "put down" right now. As a matter of fact, we think as we anticipate this next sentence that all doubts can be clarified with the one statement: "Specials are no longer specials as we used to know them." Today, more and more, their components are rearrangeable to meet the changing needs of the owner. This week one production result, next week another when the Start button is pressed.

Industry has supplied itself with many standard machine components which are compatible and/or interchangeable in many areas. This answers the problem of price and what to do with "the thing" when your production picture changes. And, for the most part it shows that design and build time need not be overly long.

This article was sparked by a description of the machine shown in Fig. 2, designed and built by Neitlich Associates, Stamford, Conn.

The machine pictured here is typical of a building-block-constructed "special" for the large or small manufacturer. It drills from both sides of the part simultaneously. The work could have just as easily been done with horizontal spindles had a table-top base been available; but as it is, it takes up less floor space, and is easy to load, and weighs less.

The machine was built for a leading chain saw manufacturer whose particular product component called for two blind holes. Since the chain saw line comprises a variety of sizes, column mounting of Dumore drill heads provides needed flexibility. Setup is easy too.

Speaking of ease of setup, most power or control components have "plug-in" units. Should the user at some future time require a different setup, it's easy to unplug and rearrange. Rearrangement might even be on a different base using more or fewer of the existing "hang on" components.

As to operation: The workpiece for the pictured operation is located on pins in the fixture. The operator presses a foot button that activates two "stock" air clamps, which in turn operate the drill heads. It's all automatic. After drilling they retract automatically and unclamp.

The unit is equipped with a safety retract feature should the cycle be started without a workpiece—or without proper location of the workpiece. A chip blow-off is also provided. Although this setup doesn't include lubricant-flow equipment, it could easily be "hung-on." —W. E. H.

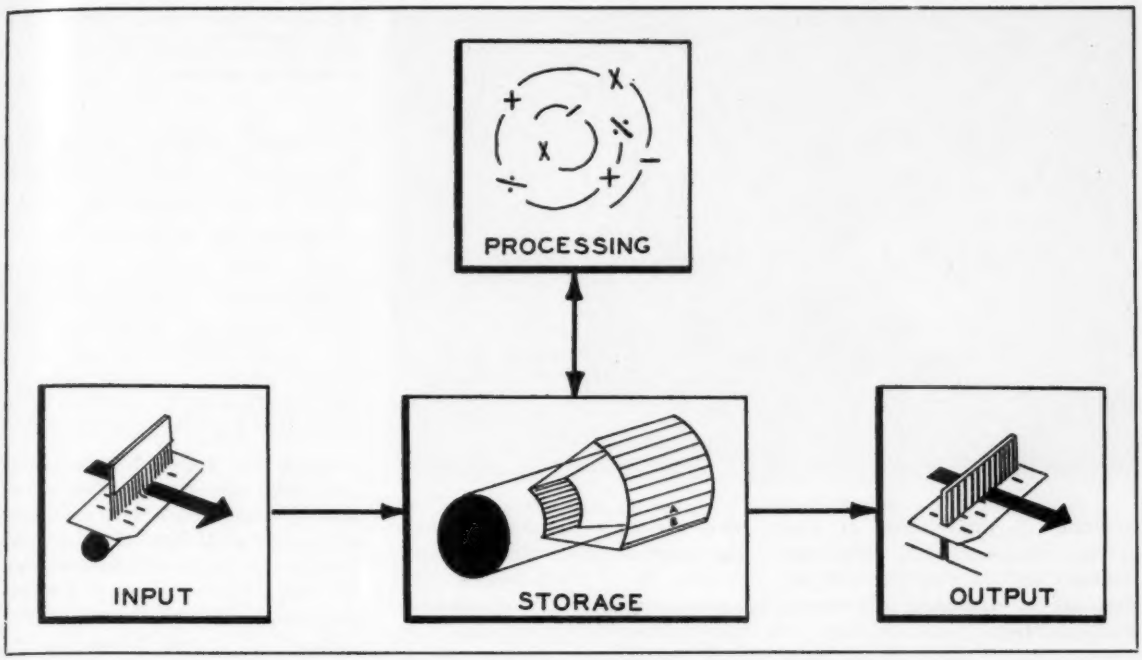

Fig. 1. Flow of information in a computer is from the input unit, to the storage drum, to the processing unit, back to storage, and finally to output in the form of punched cards.

Mr. Production Man,

Meet the Computer

by Charles Weiner
Assistant Editor

AUTOMATIC COMPUTERS play an important role in today's industrial operations. Applications of these information machines are increasing so rapidly that metalworking managers, designers, and production men can no longer be satisfied with the "black box" concept; they realize that proper use of a machine depends on an understanding of what makes it tick.

Computer operations should not be a mystery to anyone acquainted with the more familiar machines of the metalworking industry. Actually, computers and chipmaking machines are similar in many respects.

A machine tool takes a properly loaded workpiece, and when equipped with proper tools, carries out operations such as cutting and drilling of the workpiece. These operations are done according to a pre-determined plan, as specified by prints or process sheets. The machine finally discharges a finished piece which has more value than the original piece.

In a computer the workpiece is data which is "loaded" into the machine by punched cards or tape. Mathematical operations are performed on the "workpiece" using electrical and electronic circuits for "tools." These operations are carried out according to a predetermined plan or program. The finished product, discharged in the form of punched cards, is information of greater value than the original data.

Automatic digital computers are capable of processing large

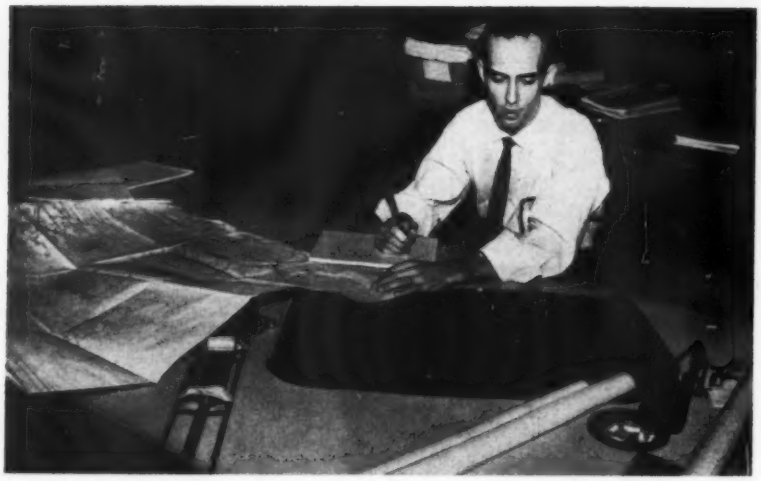

Fig. 2. Information from a conventional engineering drawing is analyzed and a coded program is prepared by the programmer.

amounts of information at high speeds and accuracies. They can combine the simple arithmetic operations of addition, subtraction, multiplication, and division to solve complex problems and can also make some simple logical decisions. All of these functions are carried out by internal electrical and electronic circuits. The tedious mental work done by men can be done on a computer at speeds measured in milliseconds.

Arithmetic and Electricity

The main difference between metalworking machines and computers is in the workpiece. It is easy to see how solid steel stock can be loaded, clamped, and machined, but how do you handle an intangible such as "information"?

Since the tools of a computer are electronic circuits the information must be put into a similar form. A special kind of arithmetic enables us to convert information into the necessary form for internal use in the machine. In this method all numbers can be expressed in terms of 0 and 1 and are therefore called binary numbers.

A form of binary arithmetic often used in the design of computers is the 8-4-2-1 system. Four columns are set up, each corresponding to a number (see Fig. 3). To write the number one, a 1 is placed in column one and zeroes are placed in the eight, four, and two columns. To write the number two, a 1 is put in column two and zeroes in the other columns. The number five would be written as a 1 in the four column, a 1 in the one column, and zeroes in the

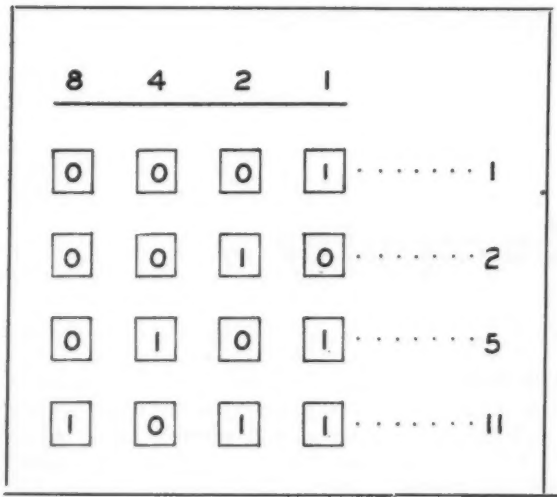

Fig. 3. Binary number system. Each column of boxes has the value shown at the top. Numbers are read from left to right by adding the value of each box containing a 1. The total value of the boxes is one in the first row across, two in the second, and five in the third.

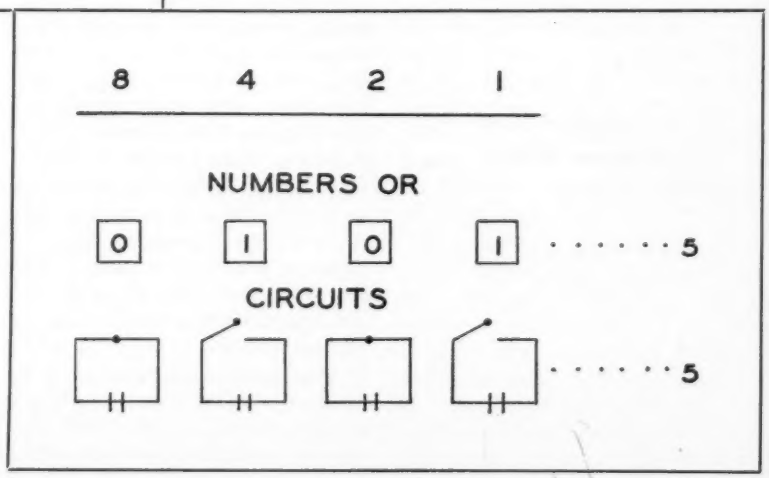

Fig. 4. Simple circuits can be used to represent numbers. A closed circuit represents a 0 in a box and an open circuit is used for a 1 in a box.

other columns. Eleven can be written as a 1 in the eight column, zero in the four, 1 in the two, and 1 in the one column. In each instance, adding the assigned values of the columns equals the number. Combinations of these four-column setups are used to represent larger numbers.

Information in the form of numbers can be represented electrically using the 0 and 1 arrangement. Vacuum tubes, electrical circuits, and even wall light switches are basically two-state devices. When the circuit is closed, current flows; when it is open current does not flow. A closed circuit corresponds to 0 and an open circuit corresponds to 1. The number five, then, would be written in binary form as 0101 and could be represented schematically by a row of four circuits in this order; closed, open, closed, open, (see Fig. 4).

Information which can be put into numerical form can thus be used in the computer in the form of electricity. Actually computers use complex circuits which are related by timing devices. Special circuits control the transfer of the information within the machine; other circuits operate according to laws of mathematics and logic to change the information.

Preparing the Input

Let us follow a complete computer cycle to see how information is prepared, loaded, processed, and discharged.

The first step is to determine exactly what information you already have and what it is you are looking for. Once the problem is clearly defined it is analyzed and put into mathematical form. From this point on, all of the information is expressed symbolically. For a simple example, the problem of finding the cost of one part if 10 parts cost $100 can be expressed symbolically as $100 \div 10$.

After the problem is converted from English language to math-language a set of instructions is prepared to tell the machine how to solve the problem. This list of instructions, or programs, is put in the form of a coded "machine language." On many computing machines each "word" of the machine

Fig. 5. Coded programs are transferred to key punched cards.

language is represented by a ten-digit number.

The words, which represent both the data to be used and instructions on what to do with this data, are transferred onto cards or tape. This is done by punching holes in appropriate places on cards or paper tape, or by sensitizing spots on magnetic tape. Information from the external world is thus stored in the form of machine language symbols.

When the preparatory steps of analyzing, programming, and card punching are completed, the information is ready to be loaded into the computer. Cards or tapes are loaded into the input unit where the machine language symbols are converted into electrical signals. Information from punched cards or tape is "read" into the machine by small wire brushes which pass over the card. When the brushes pass over a hole they come in contact with a source of electricity and produce a signal. If magnetic tape is used as the input medium, an electromagnetic reading head induces a signal each time a sensitized spot passes over it.

Machine Has A Memory

Signals from the input unit go to the "memory" or storage of the computer. The function of this part of the machine is to retain information to be processed and also the directions for processing. It can be thought of as a wall rack containing many small pigeon holes. Each instruction or data word is transmitted from the input unit to a specific pigeon hole.

One type of computer storage is a magnetic drum. It operates on the same basis as magnetic tape in a tape recorder, except that the magnetic coating is spread over a cylindrical drum and many heads are used both for playback or "reading" and recording or "writing." A signal from the input causes the recording head to sensitize spots on a specific location on the drum. The drum rotates so that all regions are available for use and many pigeon holes can be used for storage.

Another type of storage consists of an array of small magnetic cores which are given polarity in one of two directions in response to electrical signals. Vacuum tubes, and electrostatic tubes can also be used for internal storage of information.

Words read into storage by the input unit can be supplemented by information from prewired plugboards which are inserted into the machine. Wire cords are plugged into the terminals of the board so that when it is inserted into the machine signals are sent directly to storage.

When all instructions and data have been read into storage the operator presses the "start" button and the machine goes into action. It carries out the program automatically under its own control.

How the machine accomplishes

this may be understood more clearly by taking a human example. Suppose that the plant manager was going on a trip for several weeks. He needs to give instructions to his engineer so that the work will be carried on properly while he is gone. Unfortunately, the engineer does not speak English, but, like all engineers he does understand numbers.

To solve the problem of communication the manager sets up a rack of pigeon holes and numbers them from one to one hundred. In each box he puts a piece of paper with a ten-digit number written on it. The number is part of a code understood by the engineer. When the manager leaves he tells the engineer to look in box number one for his first instruction.

The number in the first box is broken down into three parts. The first two digits tell him what to do, the next four tell him on what to do it, and the final four digits tell him in what box he will find his next instruction. A number such as 68 0083 0002 might mean perform the milling operation specified on the order slip found in box number eighty-three and go to box number two for your next instruction. Box number two will have another instruction in the same form and will refer to another box for the next operation to be carried out. In this way, all operations are done in the proper sequence while the manager is away.

Automatic Internal Control

The control circuits in a computer are similar to the engineer and wall rack example. They extract an instruction word from a storage location on the drum and transfer it to a temporary storage register. The instruction is examined and information is moved and processed within the machine as specified by the instruction. After completion of the operation the next instruction is carried out in the same manner.

For example, the instruction at the first location might say: add the contents of location 10 to the contents of location 20 and store the results in location 30. The computer looks into location 10 and finds the number 80 there. It then finds the number 75 in location 20. Both numbers are moved to the adding unit which produces the sum 155. This result is then stored in location 30, and the computer goes on to the next instruction.

Of course the actual numbers are not at the storage locations, but only their symbolic representations in the form of the magnetic polarity at the particular spot on the drum. In carrying out the first instruction the storage drum rotates until the spot corresponding to location 10 is under the reading head. The state of magnetization of this spot induces a current and sends a signal to the adding circuit.

Another rotation of the drum to location 20 yields another signal to the arithmetic unit. The adding circuit, operating according to the laws of addition, combines the signals to produce a new word corresponding to the sum. The sum signal is transmitted back to the drum and read into location 30.

If the machine is later instructed to discharge the contents of location 30, the drum rotates, the spot is read, and a signal is sent to the output unit. At the output unit the signal is converted to symbols on cards or tape and discharged. The symbols will correspond to the sum of 80 and 75 or 155.

Output of a computer is usually in the form of cards or tape although other methods are also used. This phase of the operation is the reverse of the input process. The control circuits send signals to the output unit where they are converted to punched card or tape form. These output media can either be translated into numbers by a special unit or can be used as the input for another cycle. Output cards from an IBM 704, for example, are converted to control tapes which direct the operation of automatic contouring machines.

Circuits Are Building Blocks

The basic principles of computer operation, presented in only a simplified form here, are not very difficult to comprehend. What does seem amazing is the extent of the results that can be obtained when the mathematician and the electrical engineer combine their skills to produce an intricate network of ingenious circuitry based on these principles.

Today's automatic electronic computer can solve complex problems involving higher mathematics, examine all possible combinations of variables and select the best, and manipulate thousands of symbols at lightning-fast speeds. Its built-in Quality Control system allows the computer to check its own accuracy, keep track of all internal actions, and modify its own instructions.

Sub-Routines

Many techniques are used by computer designers and programmers to enable the machine to accomplish these feats. One of these methods is the use of special pro-

Fig. 6. After the cards are inserted into the input unit the operator presses "read" button on computer console.

grams stored in the memory drum to carry out specialized series of operations which are likely to be used repetitively. These special internal programs are called sub-routines and are similar to sub-assembly operations in manufacturing. In industry, certain components are fabricated in sub-assembly operations and then become part of an over-all assembly. In a computer, information requiring special operations is processed according to a series of instructions making up the sub-routine, and the results of these operations are moved back into the regular routine or program for further processing.

For example, finding the square root of a number is accomplished in a computer by a combination of addition, subtraction, multiplication, and division operations. These operations are essentially the same for finding the square root of any number.

Instead of preparing an instruction for each of the necessary operations every time a square root of a number is needed, the instructions are pre-wired into the machine or stored on a special section of the drum. The square root of any number can then be found by an instruction which initiates the processing of the number by the square root sub-routine. Only a few instructions are needed to transfer control to and from the sub-routine circuits.

Computing For Tape Control

The functions of a computer are being successfully utilized in the preparation of control tapes for numerically controlled machine tools. Control tapes direct the complete operation of the machines by specifying in the proper sequence the path of the cutting tool, flow of coolant, feeds and speeds, and auxiliary functions. The control unit of the machine tool reads the tape, converts the punches into electrical energy, and produces corresponding output signals to initiate movement on the machine itself. In a complex operation such as three dimensional milling, the computer's services are necessary to plot the points along the path of the cutting tool, and to relate this path to the variables of the process.

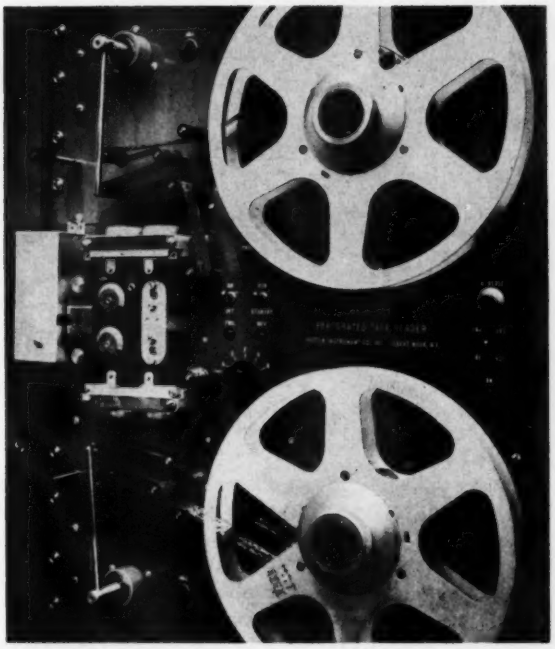

Fig. 7. The tape prepared by the computer is loaded into the control unit of the milling machine.

Preparation of the control tape starts with the part-programmer who prepares data and instructions for the computer based on a conventional engineering drawing of the part to be machined. The information he takes off of the drawing includes the x, y, and z coordinates of known points along the curves to be produced, overall dimensions of the part, location and depth of holes, and specified tolerances. Other information he needs includes the diameter of the cutter, location of clamps, and coolant requirements. If the job of selecting feeds and speeds is left to the computer, information on the material must also be included.

The program prepared by the part-programmer instructs the computer to calculate the additional points on the curves which are needed to accurately control the movement of the milling cutter. This is usually done by sub-routines stored in the computer, so the programmer only has to specify the known points and the type of curve to be generated. Information on coolant flow and other functions is programmed so that it will appear in proper sequence in the output of the computer.

A computer's output thus becomes the input to the control unit for an automatic milling machine. An English translation of the computer output (control tape) might be of this type: "Move the tool to the starting point, turn on coolant, turn on spindles, go right with the tool to point 1 (x_1, y_1, z_1), to point 2 (x_2, y_2, z_2), ..." If these closely spaced points were to be calculated without the aid of the computer it would require the expenditure of a great amount of time by highly skilled personnel. This would be especially true for irregular curves requiring many complex calculations.

The computer is an effective tool when used properly. Taking time out to understand it now can save a great deal of time in the future.

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TURN PAGE FOR . . .
"Tooling Up the Numerically Controlled Miller"

Fig. 1. The tape is loaded into the milling machine control unit by the machine operator.

Tooling Up the Numerically

THE NUMERICAL CONTROL system is as drastic a change in the way of manufacturing as any industry has ever undertaken, and it is natural that such a big change in method would require a period for solving technical problems. To understand the problems connected with tooling up the tape controlled machine, the factors that make such tooling different from conventional tooling should be examined. The following observations are taken from about two years' experience with Bendix controlled Kearney & Trecker profilers at the Lockheed Georgia Plant.

Tape control on a profile miller involves, simply, moving the cutter from one point to another automatically. The machine motions are controlled by electrical signals transmitted by the tape. Each electrical impulse actuates a machine motion.

The part programmer initiates the series of steps which ultimately lead to production of the control tape. He must have accurate information on such things as the dimensions of the part, location of the tool's starting point, positioning of stops and clamps, and size of the cutter. The milling machine does exactly what the control tape "tells" it to do. Since the control tape is only as accurate as the information from which it is prepared, proper machining of the part demands that actual locations and sizes agree exactly with the data used by the programmer.

Locating the Cutter

Accurate location of the starting point of the cutter is important since the cutter motions are specified as distances along three dimensional rectangular axes on the workpiece. All movements are based on the distance from the fixed origin of the coordinate system.

Two alternative methods for accurately locating the starting point were considered: One was to place an index button on each mill fixture so that the cutter could be given its initial position in relation to stop positions on the fixture.

The other alternative, adopted by the Georgia Lockheed Plant, was to build a "stool" or new table top on top of the old one, with an accurate 10" bushed hole pattern. An index button was designed to fit any of the bushed holes. Coordination with the position of the part to be machined is obtained by providing every mill fixture with tooling holes spaced by a multiple of 10" to match two corresponding holes in the "stool." The advantage of this arrangement is the reduction in time necessary to locate the cutter over the index button.

The tape always signals the cut-

Fig. 3. Two fixtures are mounted to "stool" because miller is programmed to mill the front side of one piece and the back side of another. Note index button (arrow).

Fig. 2. Milling machine (A), "stool" (B), and control cabinet (C).

Controlled Milling Machine

by Joseph Albert

ter to return to the index button or "home base" after completion of machining. Thus the tool is in position when the next fixture is mounted. Movements from one index button to another may be handled by the movement counter on the machine console, again avoiding the necessity of locating the cutter by indicating around a new button.

Another important N-C consideration is that the holding fixture for numerically controlled operations must hold the part at precisely selected points. It is therefore generally necessary to call for much closer tolerances in the construction of milling fixtures intended for the tape controlled milling machine. Obviously, if clamps or stop positions are not exactly where the programmer thinks they are, the part will not be machined properly.

Since the tape only describes the path of the cutter, we also found that the cutting tool must be sized accurately. This involves new standards of cutter control to insure that the programmer knows what sizes are available and the machine operator uses the size tool specified.

Tape Preparation

Preparation of the control tape is often a stumbling block to putting numerically controlled profiling into operation. The advantages of numerical control would be quickly dissipated if a man had to calculate manually all of the data that must appear on tape.

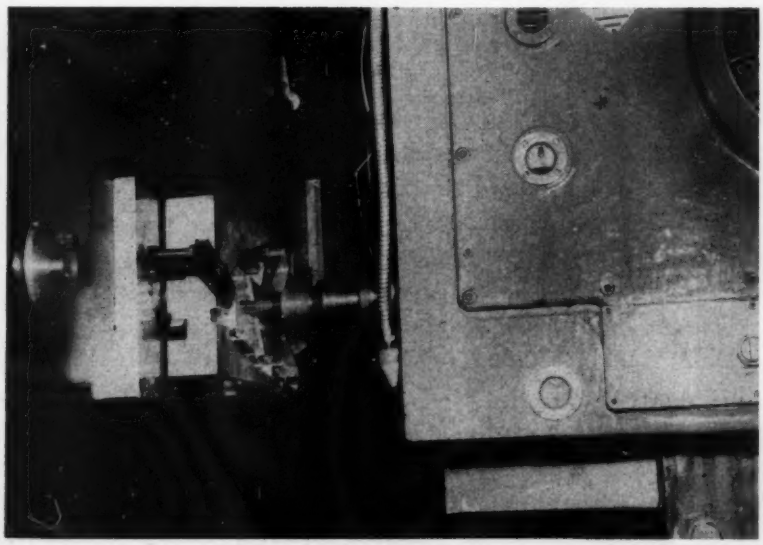
First the part programmer translates the dimensions of the part into the "language" of numbers and symbols. He also describes process variables such as feed, speed, cutter size, and coolant flow. His list of instructions, or manuscript, is transferred to punched cards, which are read into an IBM 704 computer.

The computer calculates the X, Y, and Z coordinates of small straight line elements which closely approximate the curves or arcs specified by the part drawing. These are punched into cards which are then converted to punched control signals on tape.

The control tape is threaded into the control unit of the machine, and as it unreels it actuates electrical and hydraulic signals which control the machine's motions.

Tool engineers concerned with preparing control tapes for contouring work were introduced to the digital computer. This was a somewhat overwhelming introduction at first, but the computer promises to be one of the most powerful tools at his disposal. Other problems, such as mounting and placing the fixture, are fairly me-

Fig. 4. Solid stock from previous picture is being transformed to complex part by tape controlled miller.



Mr. Albert is a Manufacturing Research Engineer at Lockheed Aircraft Corporation's Marietta, Georgia, plant.

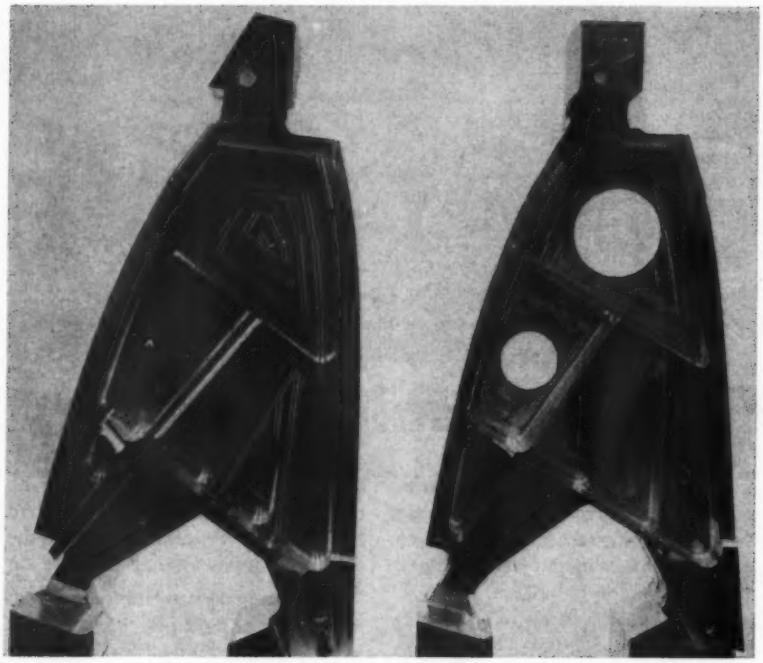


Fig. 5. Use of tooling tabs at the top and bottom of the workpiece is a common technique for holding it. The part on the left is rough machined, the other is finished.

chanical and easy to solve, but the use of the computer is a complex project that goes beyond the matter of one solution.

Many users of numerical control prefer to bypass the problems associated with computers, or to "contract" work with tapes already furnished by larger firms. These companies take advantage of pre-programmed control tapes or they send out the programming-computing-tape preparation phases to specialists who supply finished ready-to-use tapes based on the particular part requirements.

With the recent development of the APT (Automatically Programmed Tools) system by the Aerospace Industries Association and Massachusetts Institute of Technology, it will soon be possible for small companies to program parts in the simplified APT language, send the manuscript to some computer installation having the APT program, and receive a machine control tape ready for use at a nominal cost.

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New Executive Line-Up for NMTBA

Alan C. Mattison, president of Mattison Machine Works was elected president of the National Machine Tool Builder's Association at its 58th Annual Meeting held at The Greenbrier Hotel.

Everett M. Hicks, vice president and general manager of the Grinding Machine Division of the Norton Company, was elected first vice president, and Francis J. Trecker, president of Kearney & Trecker Corporation, was elected second vice president. Graham E. Marx, vice president and general manager of the G. A. Gray Co., was re-elected treasurer. Grayson M. Stickell, president and general manager of Landis Machine Company, was elected secretary.

New directors elected include Mr. Trecker, John F. Herkenhoff, president of the Minster Machine Company, and Hayward A. Gay, vice president of The Cincinnati Milling Machine Company. Ludlow King was re-elected executive vice president of the association.

A. C. Mattison

E. M. Hicks

F. J. Trecker

G. E. Marx

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New CINCINNATI Telematic Control

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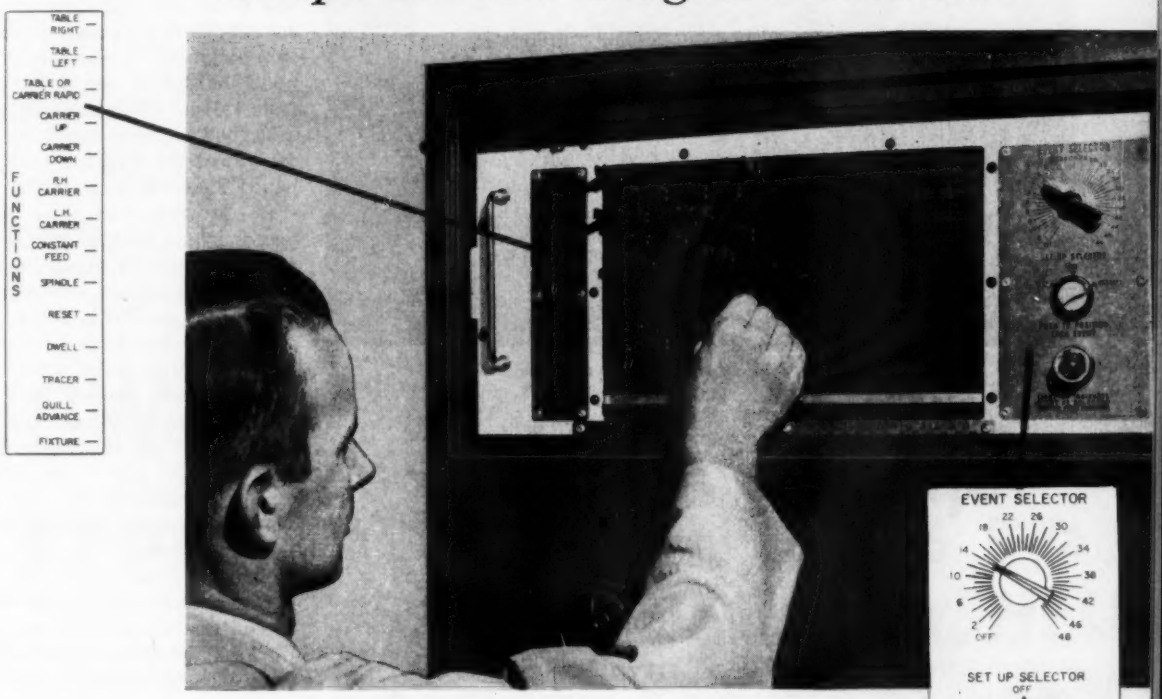

Cost advantages of automatic cycle milling now are available for smaller lots than ever before. With new CINCINNATI Telematic Control the operator programs all automatic functions of the cycle by merely inserting plugs in a panel board. If desired, a mask can be made for repeat jobs, exposing only the necessary holes. In addition to controlling all functions or movements of the machine table and spindle carrier, Telematic provides for auxiliary operations such as fixture clamping or indexing. A row of 24 holes opposite each machine function allows the operator to plug in complex automatic cycles involving up to 24 events. Additional panels, like the two-unit illustrated, can be supplied.

Telematic is the newest, most versatile and simplest of the operator-controlled programming methods. It is available on CINCINNATI 100 and 200 Series HyPowermatic Milling Machines. For details, write today for catalog M-2020-1. **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

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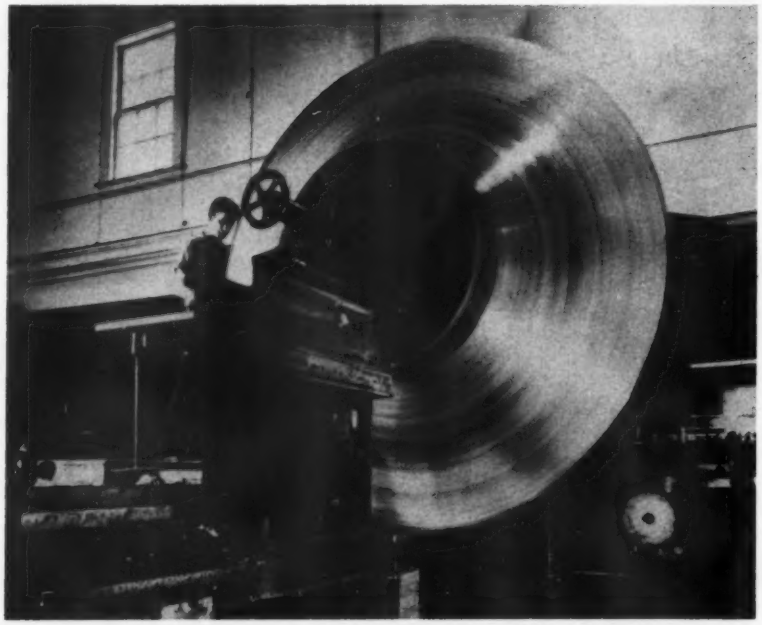

Fig. 1. Spinning a 12' Weather Bureau radar reflector.

Spinning 'Big Stuff' -- Hot and Cold

by K. Casavant and F. F. Fabio

SPINNING IS AN OLD PROCESS, one that has survived industrial progress changes and grown to occupy an indispensable role in Industry. Basically, it is the forming, over a mandrel, of a spinning disc of metal to the mandrel's shape. The metal flows ahead of the tool before the ever changing tool pressure areas. Pressure is created by a "spinning stock" or "levered" roller.

An important improvement applied recently to the old process by Torngren is the addition of a hydraulic system to increase tool pressures and control tool travel. Cylinders 90° apart are used for the compound travel of the forming roller (tool).

On light gauge metal the spinning pressure is achieved by using 200 psi air; whereas, hydraulic pressure in the same cylinder is used for cold forming the heavier metals up to ⅝" thick. Mecatorn* spinning lathes, with fluid power, take away the human effort and offer repeatability in spinning heavier metals that cannot be spun by hand. With tool pressures upwards to 200,000 psi, incremental plastic deformation of metals, such as ⅝" thick stainless steel and ¾" thick aluminum, can be achieved.

Once the tool pressures, speed, and point of in-process annealing have been established, production spinning is only a question of pushing a button or operating a control valve. The process can be described as semi-automatic, with control of the forming tool in the hands of the operator at all times.

In-process annealing, where necessary, is most important. The machine operator must determine, through experience, when the part should come off the lathe for an anneal. Otherwise irreparable damage can be done when a part has been work hardened too much. For any like configuration of the same metal the in-process anneal point will be the same, provided uniform pressures and tool travel are employed for successive parts —characteristic of power control, which provides maximum deformation before annealing. This is in contrast to the lack of control during hand spinning, which varies with each operator.

Parts such as combustion chambers and exhaust nozzles are rough machined inside and out from solid billets or forgings before spinning. The spinning gives better metallurgical characteristics and eliminates chip-making finish operations. Since the inside contour of the part bears against a polished mandrel it will assume the same degree of finish.

One particular part was formerly contour machined from a 5' dia, 14" deep cone with a 3" thick wall. It is still made from 321 stainless, but now it's being spun from a

... Continued on page 55

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Mr. Casavant and Mr. Fabio are Managers at the C. W. Torngren Company, Inc., Somerville, Mass.

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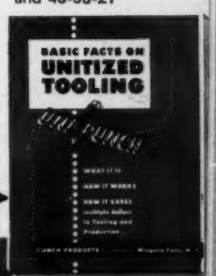

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Fig. 2. Spinning PH15-7 MO Alloy, at 1600°F, for a rocket motor closure.

5′ dia ¼″ thick disc without first contour machining. The complete cost of the part by the present method is no more than the cost of the scrap previously thrown away, to say nothing of the additional cost of machining.

In close association with this, Mecatorn machines are used for pre-forming blanks that must of necessity be machined to the finish shape. This can be done without the use of expensive press dies. Blanks are spun to assume the general configuration of the part, and then finish machined to extremely close tolerances. This procedure has been successfully employed with numerous missile parts.

Tolerances possible will vary with tooling employed, part size, part configuration, and type of material used. For instance on a stainless steel venturi section, using a hardened steel mandrel approximately 10″ in dia, tolerances as close as ±0.0015″ were achieved.

There is a distinction between this process and other processes that use tremendous pressures to extrude or shear-form material between a roller and mandrel. The Mecatorn process is spinning. This process forms shapes involving curves and re-entrant contours, as well as spinning conical and spherical sections, without the problems and expense of determining a preformed blank having a varying wall thickness. It should be noted that in using this process, final part wall thicknesses will vary depending on configuration.

Within the realm of probability, future spinning lathes will be capable of cold forming metals over 1½″ thick up to 10′ in dia. Now equipment will handle ¼″ aluminum at 16′ dia and ⅝″ stainless steel of 7′ dia. Under proposal is a lathe to cold form metals 1″ thick and 10′ in dia—further development will offer an even broader scope.

A Case at Hand

In search of a way to form large heads (65″ dia) for solid propellant rocket cases made of the newly developed high strength steels a unique hot spinning method was advanced. The metals to be spun were Armco PH15-7MO and Allegheny-Ludlum AM 355. They had an 83″ dia by 0.290″ thick starting size, and were hot spun to 65″ hemispheres with a depth of 25″. Thickness reduction was approximately 30%, and configuration tolerances were held to ±0.020″.

Considerable difficulty was encountered using standard cold spinning techniques due to the rapid work hardening that took place. One pass of the tool work hardened the metal to such an extent that it would not move on succeeding passes. This necessitated annealing after every pass and consumed much time and expense. Also it was noted that extreme thinning was taking place.

Torngren engineers found that heating the metal, while mounted, made flow easier and required less passes. And, the thinning was reduced. Difficulties arose, however, when it was learned that heating for optimum results would be around 1600°F. The problems were protection for the operator, the machine, and the plant itself. The use of steel mandrels was mandatory, and the operator, who had to stand within two feet of the work, had to be equipped with an aluminized asbestos suit. In addition the suit had to have air circulate through it. To protect the machine and the building, double walled stainless steel panels were used.

The high temperature was maintained by the use of a propane oxygen flame distributed by four torches for uniform heat. Temperature was determined by a pyrometer which indicated when they were up-to-heat. At 1600°F a tool was moved into the blank and forming around the mandrel in one pass was easy. This was repeated, and by changing mandrels the blank was brought down on the finish mandrel. At this point, the part was stress relieved and a final pass made, cold, properly sizing it to the finish mandrel. Two breakdown mandrels were used to reduce the dia step by step before the finish mandrel was employed.

To our knowledge no one had been able to form these metals in these sizes before. end

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Electrolytic Marking on a Production Basis

Fig. 1. Eight-inch saw blades are uniformly etched with heavy-black and fine-line characters. Saw blank on the fixture under the cartridge head is ready to be marked.

AUTOMATED EQUIPMENT is putting electrolytic stencil marking methods into production lines.

A large auto manufacturer, who had been using pressure-sensitive labels for replacement parts identification, discovered they were replacing more than $40-million worth of bootleg parts annually. The company changed to automatic permanent marking, with a code identification in the trade mark. Now any part returned with a perfect trade mark announces itself as a forgery — the marking has not been modified according to code.

At Black & Decker's Towson, Md., plant an automatic marker imprints a bold, heavy, 42 sq. in. trade mark on circular saw blades (Fig. 1). Only a few seconds are required to etch the mark on each blade and one stencil can be used to mark thousands of blades.

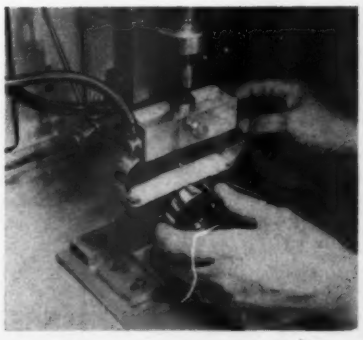
Prior to adoption of automatic marking, the saw blades were marked by a manual process. Because of the large mark surface area involved, a rocker pad was required to make a progressive stencil etch. The operation was subject to the operator's skill in hand-rocking the pad.

For automatic hand feed marking, the operator simply locates the saw blade in the fixture to trigger the cycle. Because stencil pressure and length of dwell are preset, marking quality is consistent.

Marking precision ball bearing parts posed a problem at the Barden Corporation, Danbury, Conn., until the company adopted use of an automatic instrument. Previous methods involved hand etching which proved extremely slow and again were largely dependent on operator skill in positioning and controlling the stencil.

Stamping was impractical because the hardened and finished parts would be subject to distortion and damage. Today parts are marked accurately around the outer circumference or on the flat face of bearing rings, and with little dependence on operator skill (Fig.

Fig. 2. Fine-line markings are automatically etched around circumference of precision ball bearings. Saddle-type spring-action stainless steel cartridge head brings stencil in contact with curved surface.



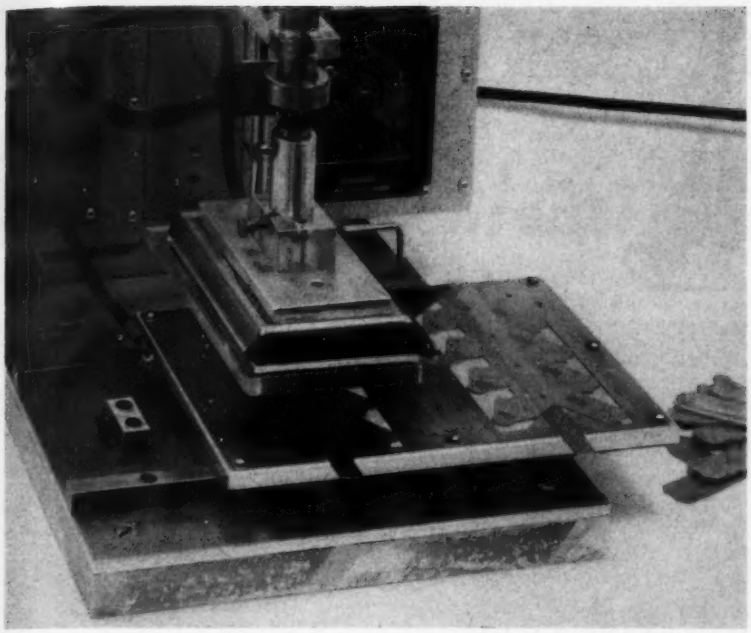


Fig. 3. Sliding carriage fixture for automatic marking of radius gages. Two-position template on fixture loads from both ends, and switches are arranged so that marking cycle is initiated when carriage is moved to either end.

2). Bearing races as small as 3/8" dia are successfully marked by other users.

Employed for purposes in addition to parts numbering, electrolytic marking identifies production runs, lot numbers, special treatments, radial play, surface hardness, and similar data.

Heart of the Lectroetch automatic marker that's being used for these purposes is a motor-operated ram, to which is attached a cartridge containing stencil and electrolyte fluid. The left-hand case mounted on the instrument frame houses a transformer, full-wave rectifier bridge circuit, voltmeter, ammeter, indicating light, and an ac-dc switch. The other case holds the adjustable timer, variable voltage transformer, on-off switch and its indicator light, and an automatic-manual selector switch. Ram travel is actuated by a capacitor reversing torque motor, which in turn is actuated by the timer.

In addition to its ability to afford uniform adjustable stencil pressure and dwell, principal benefit of the instrument is its ability to feed parts automatically. It can be converted from hand feed to index or to magazine feed in less than 15 min.

Simpler parts need only be magazined for gravity feed to the marking table. They are then advanced under the stencil with a finger mechanism synchronized with ram travel. At the end of the cycle, the marked part is automatically ejected as the next part advances to marking position.

In marking carbide throwaways an adjustable magazine that accepts triangular, square, and circular shapes is used. Regrinding does not affect the mark, as the electrolytic process penetrates the flat carbide surface to a depth of about 0.0004". Carbide marking by the automatic process, incidentally, shows remarkable economies. The best manual rate of electrolytic marking is under 400 pcs/hr. The rate with automatics is as high as 1200 pcs/hr, with fewer rejects due to imperfect marks.

For index feed, pockets are set in a 12" to 15" dia plate which rotates under the ram. Table stops are programmed by a ratchet arrangement under the plate. Irregularly-shaped parts that do not lend themselves to magazining are held in proper marking position in the individual pie-shaped pockets on the rotating plate. As the finished part rotates from under the ram-held cartridge, an ejecting pin raises it from the pocket and it is brushed from the plate by an ejector bar.

Irregularly shaped parts can be supported in molded epoxy plastic fixtures. To mold pockets for holding jet blades, for example, Lectroetch uses modeling clay, waxing the impression for mold clearance, then casting the plastic in a pie-shaped segment in the modeling clay mold. The same mold is used to cast as many segments as needed.

As a further aid to automatic electrolytic marking, users can prepare a job card for each application that requires special setup. Information is coordinated with calibrations on the upper and lower ram limits, fixture actuating linkage, timer and power settings.

A job can be set up and run, then duplicated months later, requiring reference only to the job card. For complete simplification, photos can be used to show the type of fixture employed. Calibrations are indicated as call-outs leading directly to the part where the setting is to be made.

Marking shortcuts such as these make the difference between an economical, accurate process and slow, costly methods.

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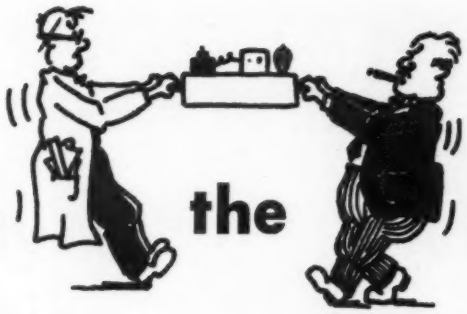
Who Owns the Invention?



by Albert Woodruff Gray

IN A DECISION of the ever recurring controversy between employees and employers over the ownership of an employee's invention, a Federal court recently made this brief summary of the law:

"There is some popular notion that so far as concerns inventions employees sell their brains to their employers. But that is not the law. On the contrary the Supreme Court has thoroughly established that while certain shop rights in inventions made by an employee while engaged in the work of his employment may accrue to the employer, no title thereto passes unless there be a plain and unambiguous contract obligation by the employee to turn it over to his employer. Only by such a contract can title to the employee's invention be obtained." [1]

Ideas vs. Application

That court may well have had in mind a famous decision rendered by the Supreme Court only a year before. In its definition of the term "shop right" it said, "Though the mental concept is embodied or realized in a mechanism or a physical or chemical aggregate, the embodiment is not the invention and is not the subject of the patent.

"The distinction between the idea and its application in practice is the basis of the rule that employment merely to design or to construct or to devise methods of manufacture, is not the same as employment to invent.

"Recognition of the nature of the act of invention also defines the limits of the so-called shop right, which, shortly stated, is that where a servant, during his hours of employment, working with his master's materials and appliances, conceives and perfects an invention for which he obtains a patent, he must accord his master a nonexclusive right to practice the invention."

In this instance two government employees were engaged in research at the Bureau of Standards' radio labs relating to the remote control by radio of bombs and torpedoes. While working on that problem they were also considering the possibility of substituting ordinary alternating current for the battery current then used in radio operation.

They succeeded, and a patent was issued to them. Later, when they refused to assign this patent to the government, a suit was brought to compel the transfer. In its consideration of this situation two features of the law governing inventions of employees developed with the facilities and on the time of employers were before the court.

"One employed to make an invention, who succeeds during his term of service in accomplishing that task," said the court, "is bound to assign to his employer any patent obtained. The reason is that he has only produced that which he was employed to invent. His invention is the precise subject of the contract of employment. A term of the agreement necessarily is that what he is paid to produce belongs to his paymaster."

In contrast to such a situation is one in which no duties of this character are imposed on the employee. Of this feature the court added, in holding these employees the owners of the patent and entitled to the benefits of their invention, ". . . if the employment be general albeit it cover a field of labor and effort in the performance of which the employee conceived the invention for which he obtained a patent, the contract is not so broadly construed as to require an assignment of the patent." [2]

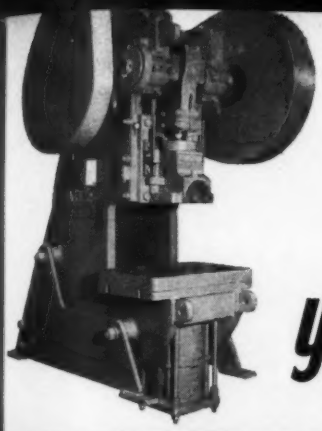
All right . . . go ahead!

A similar situation was recently before an appellate court of New York State. It involved the claim of a private employer to an invention by the manager and superintendent of his factory. The manufacturer had been engaged in the production of fuse storage cans for the armed forces.

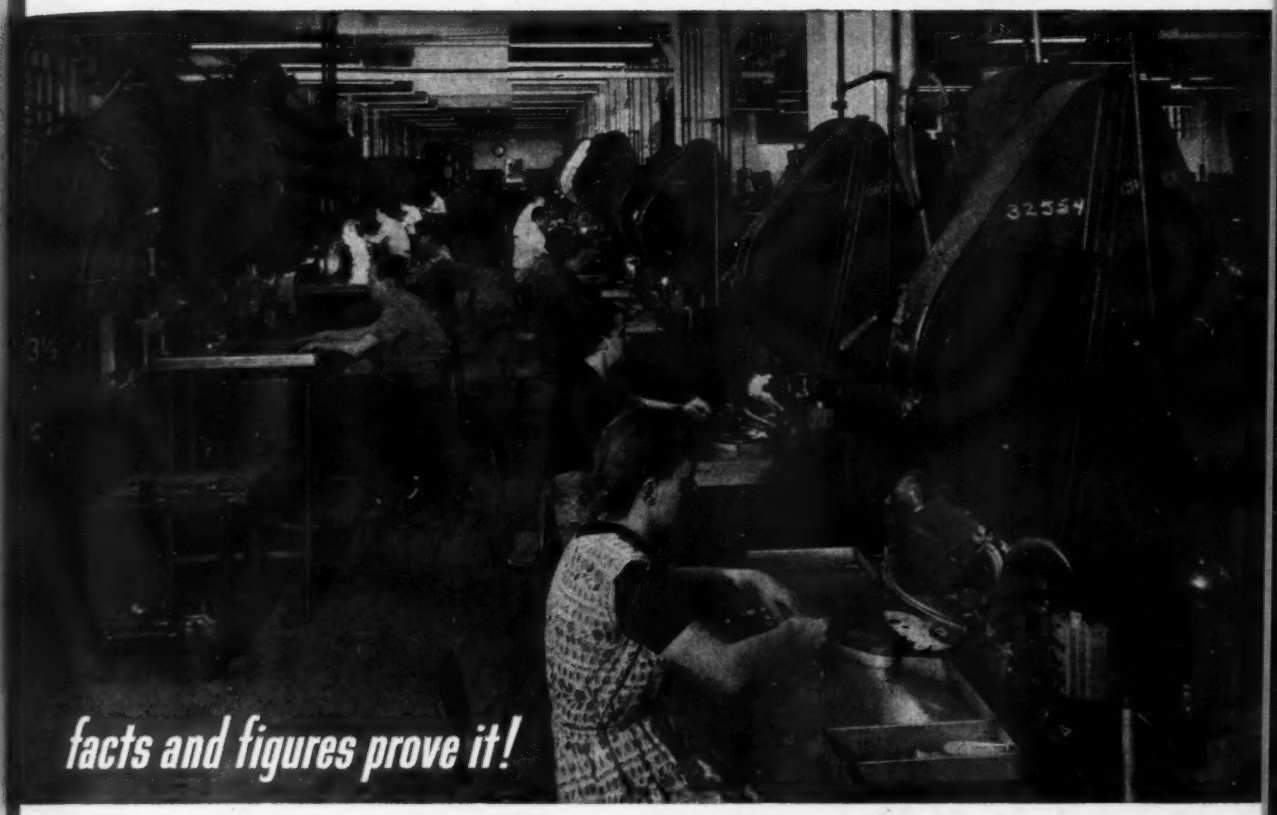
The United States Ordnance Bureau suggested the substitution of

. . . **Continued on page 62**

Mr. Gray is a lawyer and legal writer, having graduated from Yale and New York Law School, practiced law for 15 years, and written "Purchase Law Manual" and numerous articles, including "Restrictions on Patent Licenses" in the Nov. '59 T&P.



for grass roots economy you just can't match this OBI



Cold, hard statistics leave no doubt. Wherever performance data and cost records are compared, the Series A Inclinable is way out front in parts produced per dollar expended.

On the most demanding jobs . . . where the clutch is engaged and disengaged at every press stroke . . . where three-shift operation continues day after day . . . *no OBI can even approach it in thrifty operation, fool-proof simplicity, and safety.* Readily understandable are the reasons why:

Niagara's famed, multi-point mechanical sleeve clutch picks up the load on 14 engaging jaws, applying the driving force concentrically without keys or pins. Instant engagement and maximum productive strokes per minute are assured.

There are no complicated electrical circuits, relays, limit switches or solenoids . . . no palm buttons, air valves or rotary air connections. In fact no air is consumed.

With fewer parts and simpler construction, there's less to go wrong, less to repair or replace. As a result, this is not only a more economical press to operate, but a much safer press as well. Records of thousands of presses are factual proof that the Niagara mechanical sleeve clutch is unequaled in safety and reliability.

Built in 13 standard sizes, with shaft diameters from 1¼" to 6½" and capacities from 5½ to 190 tons, Niagara Series A Presses can be readily equipped with numerous accessories for individual requirements.

GET THE FACTS AND FIGURES. WRITE FOR NEW BULLETIN 58N

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CIRCLE INFORM-A-GRAM KEY NO. 59

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Gentlemen: Please ship as soon as available _____ copies of MACHINABILITY AND TOOL EVALUATION at the special pre-publication price of $5.00* per copy. Ten day examination allowed; returnable for full credit or refund if returned in saleable condition. (Note: price will be $6.00 per copy if order is postmarked after January 31, 1960.)

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What you should know before you buy any

balancing machine

What are your requirements in balancing? For plane separation? Accurate amount and angular location indication of unbalance? Operating speeds? Correction equipment? Production?

this free booklet tells you

Suppose you have a problem in weighing. Will you choose platform scales? Bathroom scales? Grocer's scales? Chemist's scales? Electronic scales?

If you balance rotating parts, remember this: there's as much difference in balancing machines as in weighing equipment.

A balancing machine is a quality control device. It indicates the angular location and weighs the amount of material which should be added or removed from a rotating assembly to eliminate vibration at the supporting bearings. It is vital that the equipment you buy to improve your product quality has the required sensitivity to do a consistent job under shop conditions.

To help you appreciate the important factors in specifying the proper equipment for your needs, Gisholt offers this new booklet. It will aid you in analyzing your type of work and provide a logical basis for your specifications and performance test requirements.

Test before you buy!

To be sure your new balancing equipment is the type best suited to your needs, *first specify*—then insist that your specifications be met. Comparative tests cost you nothing. And no reliable supplier of balancing equipment will refuse to cooperate in these tests.

Your copy of "Performance Tests for Balancing Machines" will be sent upon request. Use the coupon.

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Investigate Gisholt's Extended Payment and Leasing Plans

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Company.....

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City.....*Zone*.....*State*.....

CIRCLE INFORM-A-GRAM KEY NO. 61

. . . Who Owns from page 58

a "reusable can" in place of a "stripped" can. After conversations with the officials of the Navy Department, the employee assured his employer that he believed he had a solution of the problem. "All right — go ahead," was the reply.

Prior to leaving this place of employment, but without the knowledge of the employer, he applied for a patent. Two years later the patent was issued and suit brought by the employer in an effort to establish ownership of the invention and its patent. Holding that the invention was the employee's property the court said:

"Fundamentally an invention belongs to the inventor and his ownership persists in the absence of an agreement to assign. The mere fact that the inventor is employed by another and makes the invention during such employment, does not change these rules. Even employment to devise methods of manufacture does not of itself require an assignment of resulting inventions to the employer.

"On the other hand if the employee is hired to invent or is assigned to the duty of devoting his efforts to a particular problem a resulting invention belongs to the employer."

The court added, "Our interpretation is that the employee had the invention fully in mind before he disclosed it to his employer and that the employer's direction, 'Go ahead,' meant to use the employer's facilities and money to produce a physical embodiment of the invention." [3]

This the court supplemented with the definition of a shop right, to which, it was held here, the employer was entitled. "A shop right is a form of implied license to freely use the subject of a patent. It is not a statutory right but is found by the court on particular facts.

"It is an application of equitable principles such that if the employee uses his employer's time, money, tools, and materials to produce a useful result, it is only fair and equitable that the employer should be entitled to use the product of his own property and to duplicate it in his business. The employer's license is non-exclusive and except for that burden he who owns the patent maintains the usual rights and benefits of a patentee."

Why Were You Hired?

Distinction between employment such as that under which the fuse containers were produced and employment for the sole purpose of research and inventions under circumstances that give the ownership of the invention to the employer, appears in an action recently brought by the Bureau of Internal Revenue.

There the dispute involved payments made by a saw manufacturer to the inventor of a power chain saw. A contract with the manufacturer provided that in addition to his salary the employee should receive a percentage of the net sales price, with the stipulation, "Should any patents be granted on any of these claims I agree that these will be assigned forthwith to this company without any further compensation to me."

The Commissioner of Internal Revenue insisted that the percentage payments were taxable as salary, while the employee contended that they were payments for the patents.

Of the respective rights of the manufacturer and the inventor, stated according to the court "in capsule form," it was asserted, "A patent is property, title to which passes from the inventor only by assignment and an agreement to assign will be specifically enforced. As between employer and employee rights are determined upon the contract of employment. Absent a contrary understanding the mere existence of an employer-employee relationship does not entitle the employer to ownership of the invention of the employee even though the employee uses the time and facilities of the employer.

"If the employee is hired to invent or is assigned the duty of devoting his efforts to a particular problem the resulting invention belongs to the employer and the inventor is bound to assign to his employer any patent obtained." [4]

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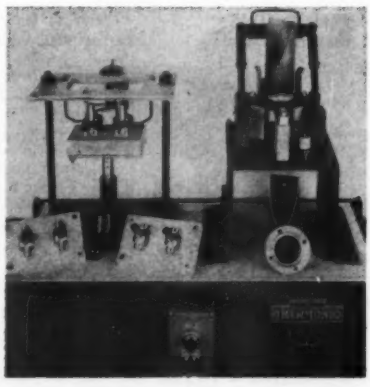
[1] U. S. Colloid Mfg. Corp. vs. Myers, 6 F.S. 283
[2] U. S. vs. Dubilier Condenser Corp., 289 U. S. 178
[3] Cahill vs. Regan, 165 N.Y.S. 2d 125
[4] Blum vs. Com'r. Internal Rev., 183 Fed. 2d 281

Extra copies of this article are available while supply lasts. Write Tooling & Production Magazine, 1975 Lee Rd., Cleveland 18.

Speedy New Setup Brazes Brass, Steel

Brass and steel valve bodies are now brazed safely, quickly, and easily with a new production line setup devised by Induction Heating Corp. for Standard Machine & Mfg. Co. Using a Model 750 Ther-Monic induction heating generator, the brass parts are brazed at the rate of two in 40 sec, and steel parts at a rate of one in 30 sec.

The unit shown consists of a sink-front table and a B Series generator. Three different sizes of brass assemblies are all done with



the same work coil. A slight adjustment of fixture height and time cycle permits successful brazing of the various types.

Brazing the steel or brass sleeve to the flange (right) is done with equal ease, and without overheating or damaging the finished threads in the body. The fixture setup insures accurate relationship between the plane of cut-off on the sleeve and the holes in the flange. For details, Circle Inform-A-Gram No. D-1.

THE BELLOWS AIR MOTOR®

THE ONLY AIR CYLINDER WITH A CHOICE OF BUILT-IN VALVES

In designing for air operation, the engineer can choose the method of valving he prefers—and still have all the advantages of integral valve and cylinder construction.

Six different built-in valve arrangements give the engineer every latitude in pneumatic design.

If he prefers to use 8-12 volt electrical control with its simplified wiring, Bellows has it. If he prefers to use 115 volt control and JIC standards, Bellows has it. If he requires low or high voltage explosion-proof control, Bellows has it. Should his design require full pneumatic control, Bellows has it. Or should he wish to control his pneumatic circuits manually or through mechanical linkage or cams, Bellows has it.

Unlike conventional air cylinders which require separate remote directional and speed control valves and dual piping, the Bellows Air Motor is a complete power unit with directional valve and dual speed control valves built-in as an integral part of the unit. Only one air connection, which can be made with flexible hose, is required.

Integral valve and cylinder construction means quick response, more positive response, more precise control and more economical operation.

The Bellows Air Motor is made in five bore sizes: 1¼", 1¾", 2½", 3⅝", and 4½", and in any stroke length.

***WRITE FOR THIS BULLETIN* TODAY!**

627-C

Four-color, 20-page bulletin describes the complete line of Bellows Air Motors. Free on request. Address Dept. TP-160 The Bellows Co., Akron 9, Ohio.

The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

AKRON 9, OHIO

OTHER INDUSTRIAL DIVISIONS OF IBEC: Sinclair-Collins Valve Co., Valvair, Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 63

ACCURACY

MASSIVE, ROUGH CASTINGS . . . are machined quickly and efficiently on the Barth Corporation's big, powerful BG-21 KELLER Automatic Tracer-Controlled Miller.

ACCURATE MACHINING . . . on the KELLER Machine means that this big automotive die will require only a minimum of barbering.

INTRICATE 3-DIMENSIONAL SHAPES . . . like the job shown here, are duplicated quickly and accurately, as the cutter follows the sensitive tracer.

ASSURED...

...AND INTRICATELY CONTOURED DIES PRODUCED QUICKLY, ECONOMICALLY WITH

KELLER TRADEMARK® **Automatic Tracer-Controlled Millers**

One of the country's largest tool and die manufacturers, the Barth Corporation, of Cleveland, Ohio, has depended for many years on KELLER Automatic Tracer-Controlled Millers to produce large, intricately contoured dies for the automotive, aircraft-missile, appliance and other industries.

Shown opposite with one of his company's KELLER Machines, Mr. John Barth – Vice President and General Manager of Barth Corporation and newly elected President of the National Tool and Die Manufacturers' Association – states, "KELLERS do intricate die jobs not otherwise possible and do them quickly and accurately. In our plant, these machines are highly regarded and are considered the only machines for the job."

At Barth Corporation, KELLER Automatic Tracer-Controlled Milling Machines are used to reproduce large plaster full-models in tool steel, with speed, efficiency and economy – producing the dies that will manufacture components for the nation's newest automobiles and appliances. Operation is easy; there is no work spoilage and no maintenance problem.

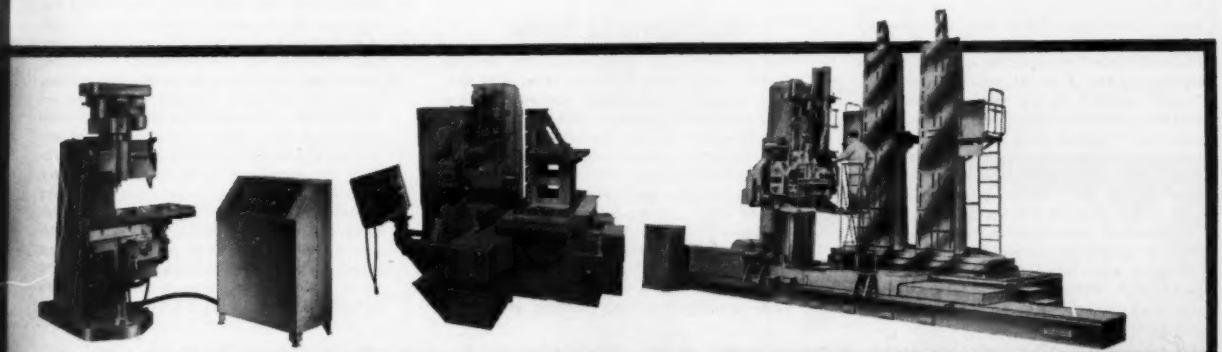
Dies, molds, prototype parts, limited-run production – and anywhere that intricate, 3-dimensional contours must be machined with speed and accuracy – a KELLER Automatic Tracer Controlled Milling Machine can help you turn out better work at lower cost. Write now for complete information, stating the work-size range you require. Pratt & Whitney Company, Inc., *15* Charter Oak Boulevard, West Hartford, Connecticut.

100th Anniversary 1860 PW 1960

PRATT & WHITNEY®

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS



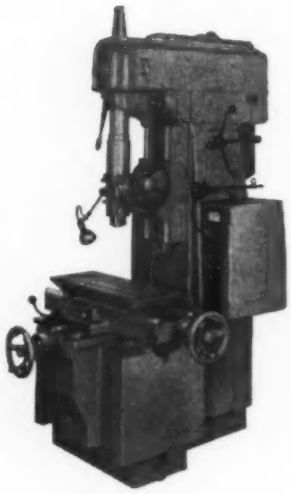
A COMPLETE LINE OF KELLER MACHINES . . . for every work size requirement is produced by Pratt & Whitney. From the compact Type BL (center) to the giant Type BG-22 (right), they provide travel capacities from 36" x 20" to 20 ft x 7 ft. Also included is the precision VELVETRACE® (left) with non-contacting tracer control capable of duplicating the finest detail to "tenths" accuracy.

CIRCLE INFORM-A-GRAM KEY NO. 65

Accuracy to the split-tenths . . .

FLASH!

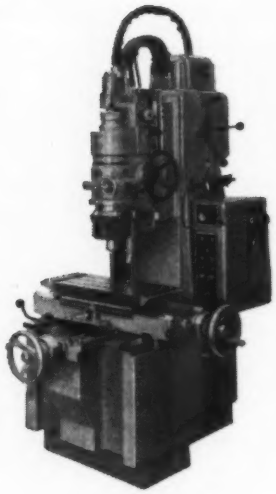
All Moore Machines Are Made And Calibrated To The New International Inch



LOCATES AND BORES HOLES TO LESS THAN A "TENTH"

No. 3 Moore Jig Borer

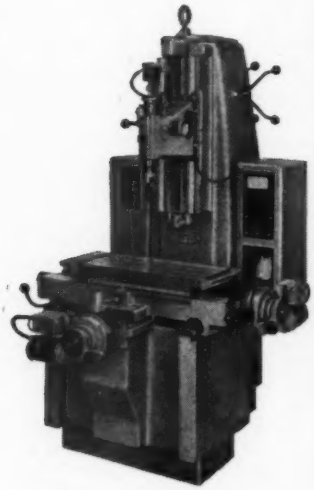
For boring, drilling, reaming and spotting holes in dies, jigs and production parts, the speed and accuracy of the Moore Jig Borer has never been equaled. Now, with this new and larger No. 3 model, you will break the "tenth" barrier! Here's why: it offers more precise positioning tolerances...all hardened, ground and lapped ways...no gibs...no overhang...improved drive...wider speed range 60 to 2250 RPM...larger table working surface, 11" x 24"...micro setting of vernier dial...more accessible cross-clamping. These new features, plus sensitive, centralized controls for spindle speeds and feeds, quick tool-changing, easy lubrication add up to a Jig Borer which belongs in every toolroom where *tomorrow's* accuracies must be achieved *today!*



LOCATES AND GRINDS HOLES TO LESS THAN A "TENTH"

No. 3 Moore Jig Grinder

The originators of jig grinding and the Jig Grinder have done it again! Now, with this new, larger No. 3 model, you can grind—*with split-tenth accuracy*—holes plus regular and irregular contours to size and location after hardening. This is made possible by the closer locational tolerances built into the machine...by the all-hardened-ground-and-lapped ways...by the faster strokes provided for chop-grinding...by the infinite spindle speeds, 40 to 250 RPM...by the larger table working surface, 11" x 24". The same quickly set precision lead screws as in the Moore Jig Borer simplify the finish-grinding process.



MEASURES TO ONE-THIRD OF A "TENTH"

Moore Universal Measuring Machine

This machine, built on the same basic principles as the No. 3 Moore Jig Borer and No. 3 Moore Jig Grinder, introduces a new concept in ultra-precise measurement and inspection. It offers *for the first time:* A machine combining the capacity for larger work-pieces; choice of electronic indicator supported on an accurate, rotatable spindle, or a universal microscope for pickup; a combination of rectilinear and angular positioning, making possible the measurement of the most complex contours. Design and construction insure the highest possible accuracy. All ways are hardened, ground and lapped steel, fitted to hand-scraped cast iron. Table positioning in two directions of travel is by means of master lead screws. Note motorized lead screw drive—it's optional (for Measuring Machine only).

MOORE SPECIAL TOOL COMPANY, INC., 726 Union Avenue, Bridgeport 7, Connecticut

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

CIRCLE INFORM-A-GRAM KEY NO. 66

Two sales promotions have been announced by the Producto Machine Co. **J. Brandon Shaw** is now eastern sales manager and **David S. Hodgson,** distributor sales manager.

Ted Palmer has joined the Holden Engineering Co.'s staff of sales engineers specializing in fluid power applications.

Appointment of **Morris E. Yancey** to serve in North and South Carolina for Morse Twist Drill & Machine Co. was announced recently.

New assistant general sales manager of the Industrial Products Division of Brown & Sharpe Mfg. Co. is **Joseph E. Kochhan.** Other changes include **Raymond H. Massie,** director of systems; **Axel Christensen,** sales manager, Brown & Sharpe Ltd.; and **Miller C. Barney,** International Machine Tool representative.

Firth Sterling Inc. has added **Fenton Tomlinson Jr.** to the West Coast steel sales staff, and **Thomas R. Quay** is now steel sales representative in the Minneapolis area.

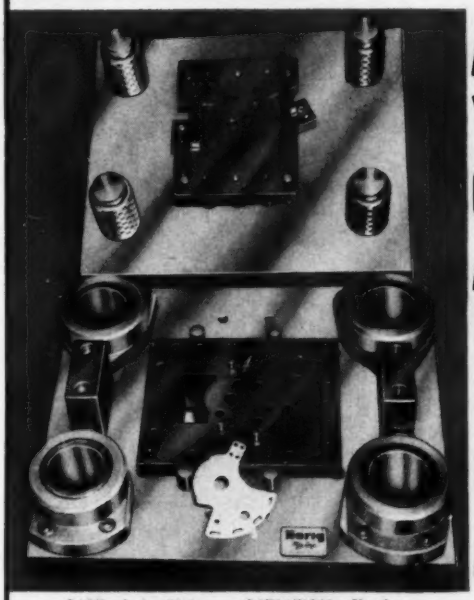
Taking over as engineering representative in the eastern sales division for Huck Mfg. Co., is **William C. Williams.**

Richard E. Wade's territory as regional manager in the West for Ren Plastics, Inc., includes California, Oregon, Washington, Idaho, Nevada, Utah, and Arizona.

John P. Baxter has joined the sales force of American Emery Wheel Works and will have headquarters in Bridgeport, Conn.

Universal-Cyclops Steel Corp. recently appointed **Maurice Mead** to represent them in Detroit.

U. S. SAVINGS BONDS ARE AVAILABLE. SEE YOUR PAYMASTER FOR DETAILS.



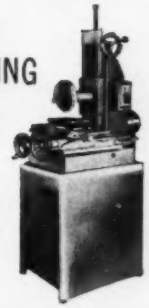
ARE YOU OVERLOOKING A HARIG CARBIDE DIE APPLICATION?

PART: Index Plate OPERATION: Shaving
MATERIAL: .063 C.R.S.

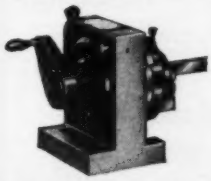
HARIG CARBIDE DIES ARE THE LOGICAL ANSWER TO LOW COST, HIGH PRODUCTION RUNS

Leading manufacturers are turning to Harig Carbide Dies for forming, drawing, shaving and notching in addition to blanking and piercing applications . . . because they consistently outproduce steel dies 10-15 to 1 (fewer grinds mean reduced maintenance and set-up costs), yet cost only ½ more than steel dies. On long stamping runs, one Harig Carbide Die can take the place of several steel dies—at a great savings to you. We would be pleased to consult with you on your next tooling program and suggest either Harig Carbide or Steel Dies to fit your needs.

HARIG GRINDING TOOLS



HARIG TML 6 x 12 SURFACE GRINDER. The tool and die makers precision grinder.

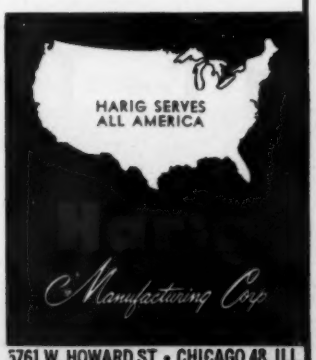


GRIND-ALL FIXTURE. The latest advancement in perforator grinding.

WHATEVER YOUR TOOLING REQUIREMENTS ... HARIG IS READY TO SERVE YOU!

ENGINEERING	PROGRESSIVE DIES
DESIGNING	MOLDING DIES
CARBIDE DIES	JIGS, FIXTURES & GAGES
LAMINATION DIES	SPECIAL MACHINING

WRITE FOR FREE CATALOG



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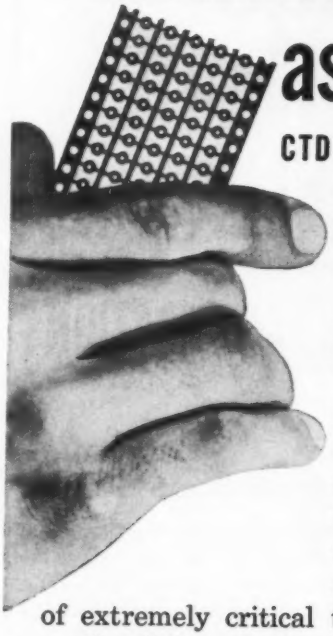
CIRCLE INFORM-A-GRAM KEY NO. 67

Cleveland Tool and Die
CASE FILE

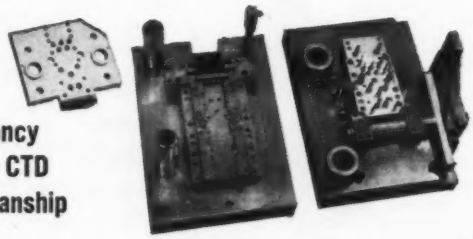
Reliability and quality assured to .001"



CTD PRECISION SECTIONAL DIES ASSURE QUALITY OF TEXAS INSTRUMENTS TRANSISTORS

Check the transistors in the next portable radio you hear, and chances are they'll read "TI" – trade mark of Texas Instruments Incorporated of Dallas, Texas. This aggressive company supplies leading manufacturers of computers, missiles and electronic equipment. For contour ground dies of extremely critical tolerances, TI chooses CTD sectional dies to stamp the tab sheets for the ultra-small semi-conductor wafer assembly within the transistor header. "Reliability and quality assured to .001" are musts," says Texas Instruments.

Another example of the important production efficiency made possible by CTD precision craftsmanship



Cleveland Tool and Die *means precision...*

Dies, Jigs, Fixtures and Special Purpose Tooling

Send for brochure describing CTD's plant and facilities. FREE!

Cleveland Tool and Die Co.
30510 Lakeland • Willowick, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 68

MEN YOU SHOULD KNOW

The advancement of **Kermit Kuck** to executive vice president of The Monarch Machine Tool Co. was recently made known.

Walter H. Venghaus, specialist in manufacturing and fiscal control, has joined The Narda Ultrasonics Corp. as vice president and manager of manufacturing.

Three new management appointments at American Coldset Corp. are **Thomas L. McSwine,** director of marketing; **Robert J. Mason,** manager of the Tool and Wheel Division; and **Royal G. Stookey,** manufacturing manager.

The board of directors of the Gleason Works recently elected **Lawrence C. Gleason** as president and general manager, and **Howard F. Carver,** vice president and assistant general manager.

C. E. Huddleston, recently appointed chief engineer, has been elected executive vice president by The Cleveland Punch & Shear Works Co.

New manager of the Plymouth Detroit assembly plant of Chrysler Corp. is **Kenneth S. Crawford.**

Newly appointed production engineering manager of the Whittaker Controls Division of Telecomputing Corp. is **John R. Morton.**

Nylok-Detroit Corp. has appointed **E. N. Wash** to serve as plant manager.

Edward J. Ferris, Jr., has been named factory manager and **Earl R. Lewis, Jr.,** production manager at Pratt & Whitney Co., Inc.

Recently appointed director of engineering for USI Robodyne Division of U. S. Industries, Inc., is **Sidney Weiser.**

Taking over as chief engineer at Brooks & Perkins, Inc. is **Earle V. Schirmer.**

. . . Continued on page 72

Cuts assembly time in half with...

NEW ROTOR J-40S IMPACT WRENCH

JOB: Driving ⅜" bolts to attach cover and insulators on distribution transformers. Formerly used ratchet hand wrench... fatiguing to the operator... a bottleneck.

RESULTS: New Rotor J-40S Air-Powered Impact Wrench (with special extension drive to clear insulators) does the work in less than half of former time. Bolt tightness is uniform. Operator fatigue is eliminated.

Ask for demonstration of Rotor portable tools to see how they can cut *your* costs! Write for a free copy of Bulletin 53B.

Courtesy Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pennsylvania.

HAVE YOURS? 100-page handbook for portable air tool users. Request on your letterhead.

Rotor Air Tools: Assembly Tools • Drills • Small Wheel Grinders Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers
Rotor High-Cycle Electric Tools: Grinders • Polishers • Sanders

ROTOR TOOLS
CLEVELAND, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 69

FELLOWS GEAR PRODUCTION Builds Extra Quality

View of production floor at Stanley Electric Tools, showing some of the Fellows Gear Production Equipment used.

Gears produced with Fellows Machines add high quality to these Stanley Electric Tools.

THE PRECISION LINE

Fellows

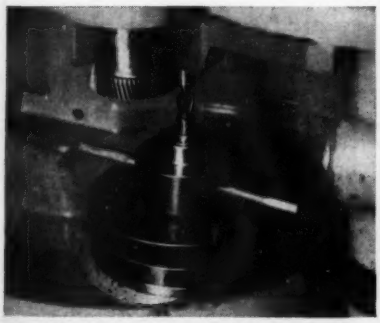
EQUIPMENT at Lower Cost for STANLEY

Stanley is a name you know . . . a name that stands for high quality in electric tools.

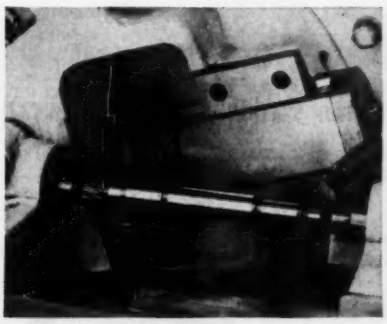
To insure this quality, while providing the high production rates that mean lower costs, Stanley Electric Tools, Division of The Stanley Works at New Britain, Conn., uses Fellows Gear Production Equipment for shaping, shaving and inspecting the armature pinions for its electric tools.

Fellows has long been the leader in Gear Production Equipment, with machines for every gear production job: Fellows Gear Shapers, Pfauter Gear Hobbers, Fellows-Reishauer Gear Grinding Machines, Fellows Gear Shaving Machines and Fellows Inspection Instruments.

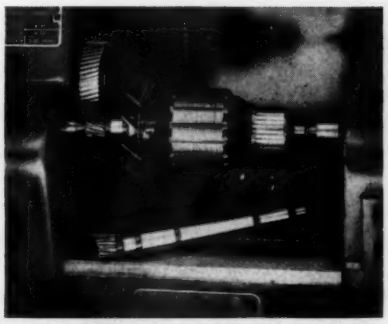
If you make gears of any size, from 1/16″ P.D. to 120″ P.D., Fellows' 60 years of experience can help you improve quality and cut costs. For complete information on Fellows Gear Production Equipment, call your nearest Fellows office.



SHAPING. The versatile No. 7125 Fellows Gear Shaper gives Stanley high production speeds (up to 450 strokes per minute). It also provides fast, simple changeover from one job to another.



SHAVING. The No. 4 Fellows Fine Pitch Shaving Machine puts finishing touches on each pinion and adds the finish which results in long life and quiet operation.



INSPECTING. The No. 4 Fellows Fine Pitch Red Liner makes and records a composite check of gear accuracy, insuring high quality standards.

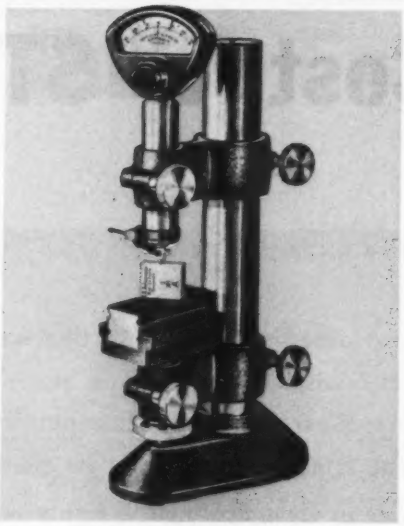
Gear Production Equipment

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices:
319 Fisher Building, Detroit 2
150 West Pleasant Avenue, Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Avenue, Los Angeles 45

CIRCLE INFORM-A-GRAM KEY NO. 71

JOHANSSON GAGING EQUIPMENT

Assures You Precision to the Finest Degree to Meet Your Requirements —Backed by the Name Supreme in the World of Measurement



GAGE BLOCKS

(JOHANSSON) and accessories. Short deliveries. Inspection and reconditioning service available at our plant.

INTERNAL INDICATORS

(for inside measurements .155 to 24 inches). Scale range plus or minus .001 graduated to .0001 and minus .020 graduated to .0001.

MIKROKATOR

(Amplifier—for outside measurements) Graduations .0001 to .000001 or .01M to .0002M.

OTHER JOHANSSON PRODUCTS

Micrometers, Snap Gages, Extensometers, Dynamometers, Hardness Testers, Surface Finish Indicators, Interferometers, Plugs, Rings and Special Gages.

MIKROKATORS
(AMPLIFIERS)
FOR MEASUREMENT IN INCHES

Catalog Number	Scale Range Inches	Graduations Inches
510-E2	0".006	0".0001
510-E4	0".0024	0".00005
510-E5	0".0014	0".00002
510-E6	0".0008	0".00001
510-E7	0".0004	0".000005
510-E8	0".0002	0".000002
510-E9	0".00004	0".000001

Write for Literature

C. E. JOHANSSON GAGE CO.

A DIVISION OF SWEDISH GAGE CO.

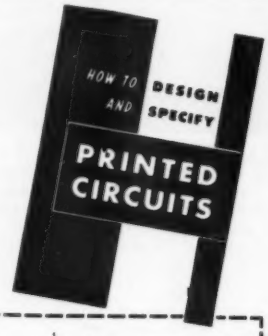
10641 HAGGERTY AVE. • BOX 4086 NORTHEASTERN STATION • DEARBORN 1, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 721

How to Design and Specify

PRINTED CIRCUITS

OVER 70 ILLUSTRATIONS are included in this new publication, reporting on: Advantages of Printed Circuits . . . Layout and Design . . . Selection of Materials and Components . . . Multiple Soldering Techniques . . . Reliability . . . Production Methods . . . Process Limitations . . . Printed Circuit Assembly . . . Service and Repair . . . Artwork . . . Finishes . . . Information on Switch Plates and Commuter Discs . . . and other valuable information. Also includes NEW RECOMMENDED TOLERANCES FOR PRINTED CIRCUITS. **$5.00**



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P. O. BOX 3505, 1975 LEE ROAD, CLEVELAND 18, OHIO

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. . . Men from page 68

Firth Sterling Inc. has appointed **R. K. Hopkins** vice president and general manager of the Steel Division, completing the separation of the new Steel and Carbide Divisions. T. G. Barnes is vice president and general manager of the Carbide Division.

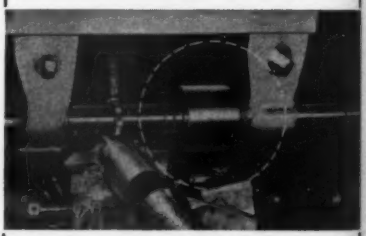
John D. Kemper is the new vice president of engineering of the Marchant Division of Smith-Corona Marchant Inc.

Classified

Wanted: Draw press with air cushion, 10" stroke min., bed area 48" x 72" min., equipped with 440v-3phase 60 cycle motor. Must be in operating condition. Otherwise it can be a relic. Send offering to Box #T-1, Tooling & Production Magazine, 1975 Lee Rd., Cleveland 18, Ohio.

Patent for Sale, or will make royalty arrangement. Product is Die Set Separator. For details, write Box #T-2, Tooling & Production Magazine, 1975 Lee Rd., Cleveland 18, Ohio.

ELIMINATE MILLING MACHINE MAINTENANCE



UPS FEEDS AND SPEEDS 200%

See how General Electric, Jeffrey Mfg., hundreds of others absolutely end arbor bushing maintenance problems and decrease production costs on horizontal milling machines by replacing the bronze outer support bushing with a Jergens "Live" Sealed Roller Bearing Unit. Jergens Units with adjustable roller bearings hold precision—permit increases in milling speeds and feeds to take full advantage of carbide cutters. The rigidity of these units increase cutter life and eliminate chatter, frozen bushings, and twisted arbors. See how hundreds save thousands! Write for FREE case histories of actual company performance reports of jobs and dollars saved.

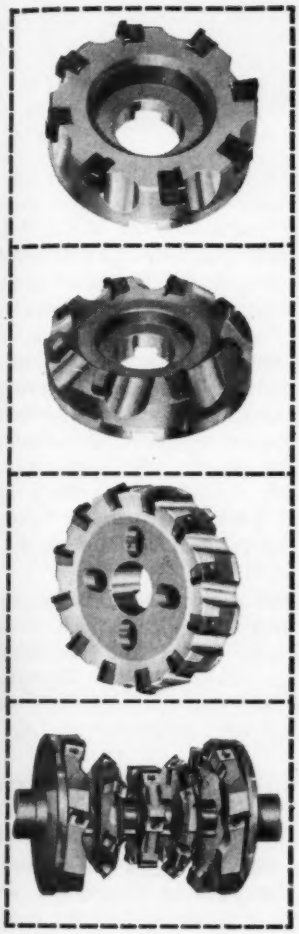
DONLEY PRODUCTS, INC.

Dept. TP-1 11106 Avon Ave., Cleveland 5, O.

CIRCLE INFORM-A-GRAM KEY NO. 722

More Milling Possible... Milling More Profitable with FUTURMILL

and a handful of carbide blades



Futurmill's indexable milling cutters converted so many *slow and expensive* machining methods to *fast, low cost* operations, that they established the value of "indexable tooling" . . . recognized as one of today's most important contributions to metalworking progress.

1. Lower cost metal removal

Futurmill takes the burden out of milling with inexpensive indexable carbide blades. No need to remove the cutter from the machine . . . no more cutter grinding and no more delays and lost production time. Index a Futurmill quickly and accurately, right on the machine. Eight times per blade with negative rake cutters and four times with positive. Futurmill's precision ground blades get the finest finish obtainable and more metal removed per cutting edge.

2. Plenty of muscle for any job

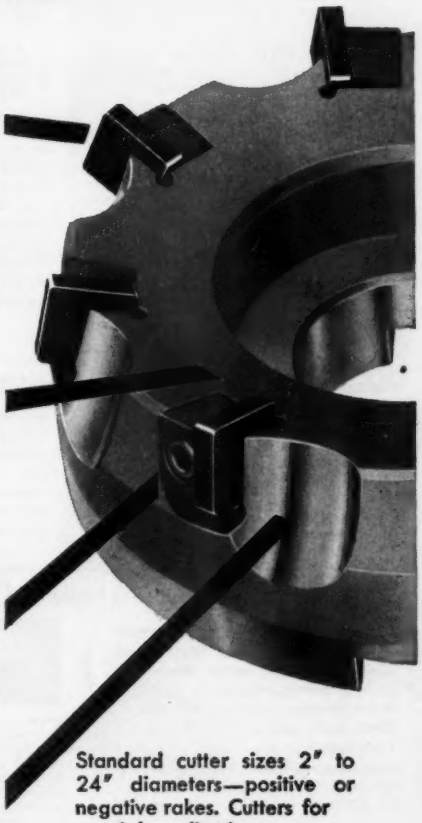
The cutter body is a solid one piece construction of heat treated alloy steel . . . not only the most rigid cutter built . . . but precision built.

3. Protection for the cutter body

The case hardened wedges behind the blades absorb the damage in case of an accident and save the cutter body . . . cutting down expense and lost production time for cutter repair or replacement . . . reducing inventory investment. With just a few extra wedges you're back in production.

4. Unobstructed chip clearance

Huge chip pockets in front of the blades direct the chips ***out and away*** from the cut—critical on steel applications and on deep cuts.



Standard cutter sizes 2" to 24" diameters—positive or negative rakes. Cutters for special applications.

FUTURMILL, INC.

6360 Highland Road • Pontiac, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 73

Catalogs and other helpful literature

A 52-Page Induction Heating catalog discusses new equipment models, gives specifications, and describes applications and case histories. Get Catalog D3-2 from Induction Heating Corp., or Circle Inform-A-Gram No. C1.

Screw Machine and estimating departments will find thread information, tap drill sizes, and weight and size charts in "Die Headlines," Vol. V, No. 2, from The Eastern Machine Screw Corp., or Circle Inform-A-Gram No. C2.

$595 BURGMASTER Bench Model "O" Turret Drill Replaces $1650 Drilling Machines

Burgmaster Bench Model "O" 6-Spindle Turret Drill ¼" Drill Capacity in Steel — ⅓ H.P.

Brass Galvanometer Body drilled 63% faster on Burgmaster Bench Model "O" Machine. Six holes are held to ±.0005".

63% More Production in 1/3 the Floor Space

A leading manufacturer of electronic equipment uses a Burgmaster Bench Model "O" 6-spindle Turret Drill to perform precision drilling and tapping operations. In the operation shown, six holes requiring five diameters are drilled in a galvanometer body. Holes range from .029" to .113" in brass and are held to .0005" in a jig. The Burgmaster machine, costing $595, replaces five single spindle drills costing $1650 and increases production 63% in 1/3 the floor space.

These striking economies are made possible because of unique Burgmaster features. The turret power indexes, at operator command, to perform up to six operations at one location. This speeds production by eliminating drill jig moving required on a line of single spindle drills, and an estimated 650 miles of operator walking per year. Pre-selective, automatically shifted spindle speeds, preset precision depth stops, and a sensitive feed handle assure the most efficient working rate while increasing tool life.

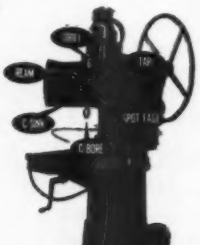
$3450 Burgmaster Turret Drill Replaces $11,000 Machine

Complex Rocket Part is machined at Cadillac Gage Co., West Coast Division on Burgmaster Model 1C costing $3450, replacing $11,000 in single-spindle drilling equipment. Operations now save 75% of the floor space.

Burgmaster Model 1C Six-Spindle Turret Drill — 12 speeds from 325 to 4050 — ½" drill and tap capacity in cast iron — 1 h.p.

Burgmaster Model 1C Six-Spindle Turret Drilling and Tapping Machine

Burgmaster Dealers are located in principal Industrial Centers. Write for literature—covers machines and accessories.



World's largest manufacturer of turret-type drilling and tapping machines.

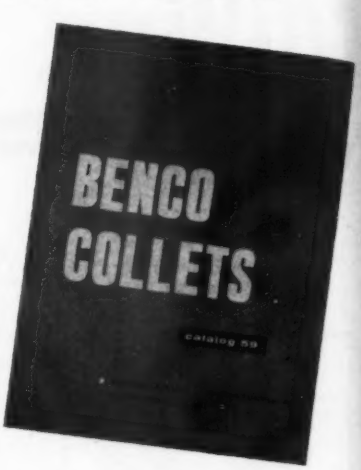
BURGMASTER CORPORATION

SMALL TOOL DIVISION — BURG TOOL MANUFACTURING CO., INC.

13001 S. Figueroa St., Box 311, Gardena, Calif. • Phone: FAculty 1-3510 — Phone, wire or write Dept. OA

CIRCLE INFORM-A-GRAM KEY NO. 74

Collets, Pushers, feed fingers, and pads for screw machines are illustrated and described in Catalog 59 available from Benco Collet Mfg. Co., or Circle No. C3.



For On-the-Spot Checking, regular inspection stations, and laboratory work, use the Model B-2 comparator for use with dial indicators, described in Bulletin F from Petz-Emery Inc., or Circle No. C4.

Convert Shop Air into intensified hydraulic pressures by using the air hydraulic boosters described in a 24-page engineering bulletin. Selection chart and application data are included. Get Bulletin B-200P from Flick-Reedy Corp., or Circle Inform-A-Gram No. C5.

A 1960 Metalworking Tools catalog includes specifications on a rod cutter series and universal bending brakes. Write Whitney Metal Tool Co., for your copy, or Circle Inform-A-Gram No. C6.

A High Strength Steel bulletin contains engineering and maintenance applications for Viscount 44 steel. Physical and mechanical properties charts are included. Request a copy from Latrobe Steel Co., or Circle No. C7.

Precision Chucking Devices, that hold, center, and round up large diameter precision components for inspection or machining, are discussed in a bulletin which gives advantages, design, and construction details. Ask for Bulletin 634 from Pratt & Whitney Co. Inc., or Circle Inform-A-Gram No. C8.

Catalogs . .

A New Alloy Steel Screw engineering handbook contains 36 pages of specifications for numerous types of screws. Get Handbook book 500 from Mac-It Parts Co., or Circle No. C9.

A 96-Page Precision Measuring Tools and instruments guide and catalog features a complete line of measuring tools, optical measuring equipment, gear hobbing and gear testing machinery. Write Scherr-Tumico for Catalog 25, or Circle No. C10.

Hydraulic Shears are discussed in a 15-page catalog that gives construction details and specifications of models for cutting metal up to 30′ long and 2″ thick. The Cleveland Crane & Engineering Co. supplies copies, or Circle No. C11.

Industrial Heat Processing Ovens are highlighted in a bulletin which gives specifications on both batch and semi-automatic continuous ovens. Hevi-Duty Electric Co. supplies Bulletin 159, or Circle C12.

A Hose Fittings Finder contains helpful data for selecting industrial hose and fittings for hydraulic applications. Bulletin 4406B1 from Parker-Hannifin Corp., gives details, or Circle No. C13.

"Rack and Pinion Roll Feeds for OBI Presses," a 15-page catalog, covers operating and economical advantages of automated press operation. Bulletin A-11 is available from F. J. Littell Machine Co., or Circle Inform-A-Gram No. C14.

"The Technology of Bunting Bearing Aluminum Bars" lists economic advantages and includes charts for cuts, speeds, and feeds. Get a copy from The Bunting Brass and Bronze Co., or Circle No. C15.

Mechanical Dust Collectors are discussed in a bulletin which has detailed drawings and application diagrams of the new involute design. Bulletin 300 is released by Research-Cottrell, Inc., or Circle No. C16.

Uses of Wire and Strip components are described in a new design handbook. Hints to help cut costs and descriptions of major types are included. Request a copy from E. H. Titchener & Co., or Circle No. C17.

"Shuffle Hearth Furnace" lists what this furnace can do and the features of it for atmosphere heat treating and quenching. Specifications are included. Ask for Bulletin SEC-7 from Sunbeam Equipment Corp., or Circle No. C18.

"Still the Best Performer"

3P PUNCHES DIE BUTTONS RETAINERS

GET THESE EXTRAS AT NO EXTRA COST

X Greater Economy X Immediate Delivery
X Complete Interchangeability

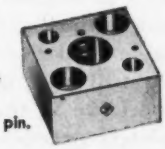
HEAD TYPE PUNCH
Made To ASTE
Standards with Forged Heads

PRESS FIT
DIE BUTTON
for heavy duty
usage

BAL-LOK PUNCH
Light & Heavy Duty

BAL-LOK
DIE BUTTON
Uniformly
Hardened

KWIK-PULL
RETAINER
End & Square.
Designed for easy
removal from
position on dowel pin.



HEAD TYPE
DIE BUTTON
For long wear-
life and heavy
duty usage.

Porter Precision Products grind their products to any decimal size, and at no extra cost. Immediate delivery from stock. Distributors in all principal cities. Order 3P quality products and enjoy substantial savings. Cut your inventory, your costs and down time, with 3P products made of Graph-Mo Tool Steel that gives extra long wear life. Write for 3P Catalogue No. 200.

PORTER PRECISION PRODUCTS
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CIRCLE INFORM-A-GRAM KEY NO. 75

NEW FLOOR MODEL A-F

Wilder MICRO-PROJECTOR with VERTICAL LIGHT BEAM

Quality Control plus Cost Control

- Completely versatile. For production inspection or as contour measuring projector.
- Choice of 3 measuring stages 1" x 1", 2" x 2", 2" x 4".
- Full set of lenses between 10x and 100x magnification.
- Full length cabinet eliminates separate worktable.
- Detachable shelf optional.

Write for New 12 page catalog 357.

OPTO-METRIC TOOLS, INC.
137 TP Varick St., New York 13, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 761

An authoritative and complete coverage of every phase of . . .

PRODUCTION CONTROL

by NYLES V. REINFELD

Founder and Managing Director of the National Institute of Management, Inc.

BASED ON AN EXTENSIVE SURVEY, this comprehensive new book presents the results of seminars with more than 500 companies throughout the United States and Canada. The questions and the answers emerging from round-table discussions with more than 1500 production control men, as well as Mr. Reinfeld's pioneer experience in the field, form the nucleus of a completely practical and flexible guide. 340 pages; over 100 illustrations. $8.00

HUEBNER PUBLICATIONS, INC.
P. O. BOX 3505, 1975 LEE ROAD, CLEVELAND 18, OHIO

Please send ..... copies of "PRODUCTION CONTROL" at $8.00 each postpaid. (Ten day examination allowed; returnable for full credit or refund if returned in saleable condition.)

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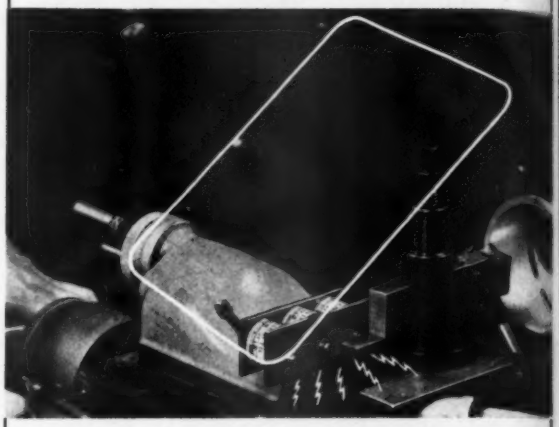
Magnetic
MACHINE TOOL GUARDS



. . . will control your shop-flak and stop those missile-like chips from making you their target. Powerful Alnico magnetic bases,—regular or giant size,—position five sizes of clear plastic shields where needed. Popular size, 8" x 10", with regular base @ $9.25; with giant base @ $15.95 f.o.b. your plant in USA.

ORDER TODAY! Write for literature — try them!

The DILLEY *Manufacturing Company*
1600 Doan Avenue, Cleveland 12, Ohio • Tel.: Liberty 1-0606

CIRCLE INFORM-A-GRAM KEY NO. 762

WALTON'S SPECIAL OFFER
gives you a set of
Tap Extractors FREE

A short time ago we introduced our new **"Style B" Tap Extensions.** As part of a continuing program to make these new tools well known throughout the metalworking industry, we are offering a limited-time SPECIAL:—With each set of (9) "Style B" Tap Extensions bought, we include FREE a set of (6) Tap Extractors. Act before the expiration date for your free sets. No quantity limit.

OFFER POSITIVELY EXPIRES FEB. 29, 1960

Buy this set of nine (9) "Style B" Tap Extensions at regular price. Our newest — for both machine and hand tapping. Metal box included.

Receive FREE this set of six (6) Tap Extractors in sturdy metal box. Walton hand extractors, widely used, remove broken taps easily and quickly.

See Your Industrial Distributor

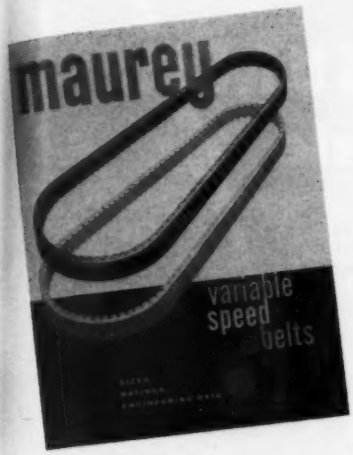
Or Write for Data *Folder No. 38*

SINCE 1908 WALTON TOOLS HARTFORD, CONN

THE WALTON CO. HARTFORD 10, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 763

Catalogs . .



A 32-Page Belt Selection Guide for variable speed belt users contains ratings, sizes, and engineering and application data. Contact Maurey Mfg. Co., for Catalog VSB-1, or Circle Inform-A-Gram No. C19.

Prevent Rusting by using Rust Veto 377, described in a bulletin. It can be applied to wet or dry surfaces. Get a copy from E. F. Houghton & Co., or Circle Inform-A-Gram No. C20.

Rapid Sinking of die cavities and odd-shaped holes in any metal is provided by the new high-powered spark-errosion machining method that's explained in a bulletin. Bulletin R10 from Easco Products, Inc., gives details, or Circle C21.

A Comparison Chart for stainless cold heading wire compares cost, corrosion resistance, and cold heading characteristics of the commonly used grades. Get one from Universal Cyclops Steel Corp., or Circle Inform-A-Gram No. C22.

Fluxes, Solders, and soldering supplies are presented in a new catalog that describes the types for numerous applications. Get Catalog C-1 from Johnson Mfg. Co., Inc., or Circle No. C23.

Tensile-Testing Machines with up to 40,000 lb capacities are outlined in a bulletin that includes specifications and methods of operation for manual and motorized hydraulic models. Ask for Bulletin T-859 from Steel City Testing Machines, Inc., or Circle No. C24.

"Optical Analysis of Gears and Splines" describes inspection procedure and illustrates the various steps with diagrams. It also contains charts of magnification ranges. Ask Jones & Lamson Machine Co. for a copy, or Circle No. C25.

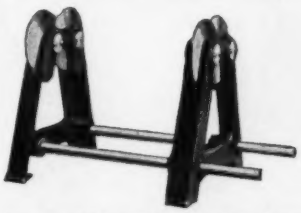
A Disc Grinding Wheel brochure now available describes disc characteristics and gives performance records for various operations. Write Macklin Co., for a bulletin, or Circle No. C26.

Lapping-Polishing Machines for mechanical polishing of metallurgical samples for microscopic examination are described in a bulletin. Specifications and operating data included. Syntron Co. supplies copies, or Circle No. C27.

Non-destructive Testing problems are answered in a bulletin which gives some examples of the range of applications for magnetic-type tests. Write Magnaflux Corp. for a copy, or Circle Inform-A-Gram No. C28.

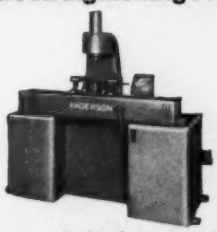
Anderson High Production Tools
CUT PRODUCTION COSTS

Precision Balancing Ways



Balance rotating parts easier, faster, more accurately. No leveling or centering required. Five sizes 20" to 96" swing, 1000 to 20,000 lbs. Precision built with chilled iron discs which rotate with minimum friction on sensitive special bearings.

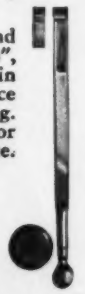
Hydraulic Straightening Presses



Straighten and check in same location with both speed and accuracy. Available with either traveling or stationary ram, power or hand operated in capacities up to 10, 25, and 50 tons. Can straighten to within .001."

Improved Hand Scrapers

Both high-speed steel and carbide-tipped blades in 18", 20", or 22" lengths. Light in weight, easy to use, reduce need for costly regrinding. Rubber bumper available for comfort and convenience.



Anderson Power Scraper

Power Scraper has a "natural hand control." Forward stroke can be regulated from ¼" to 3½ feet at 60 feet per minute. Portable, may be plugged into any electric outlet.

Anderson

WRITE for BULLETIN NO. 1-40

ANDERSON BROS. MFG. CO.
Rockford, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 77

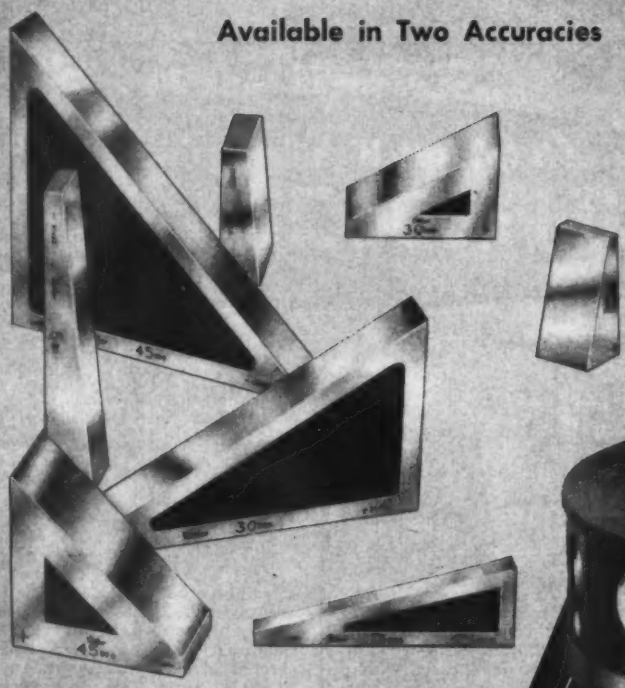
Webber GAGES FOR ANGLE MEASUREMENT

True Divisions of a Circle

TOOLS FOR THE SPACE AGE

ANGLE GAGE BLOCKS

Available in Two Accuracies



"Laboratory Master" Grade, permit measurements to ¼ second accuracy . . . a necessity for use in the guided missile, optical and precision instrument fields.

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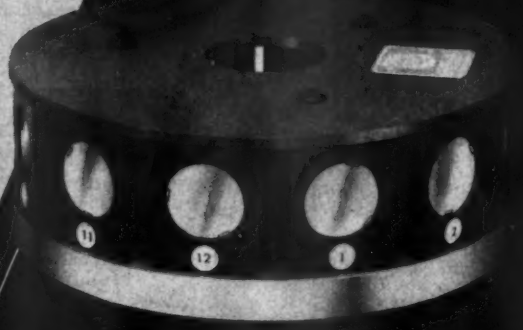

An entirely new concept in Optical Polygons. Accuracy 0.2 second of an arc. Available with any number of sides from 3 to 72 — will measure angle spacing from 5 to 120 . Any number of sides can be supplied, including unequal or mixed angularity of target surfaces.

New descriptive literature is available upon request.

Webber GAGE COMPANY

LARGEST MANUFACTURERS OF PRECISION GAGE BLOCKS

12903 Triskett Road
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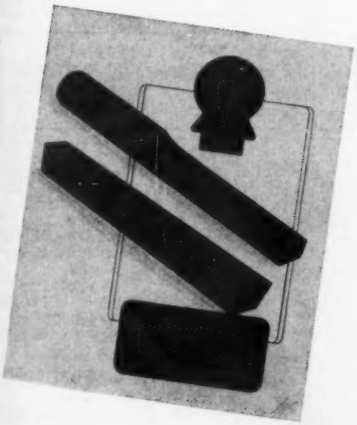
Telephone CL 1-1200

Catalogs . .

A New Jig and Fixture Components catalog contains 490 tracing templates for screws, locators, toggle pads, etc. Get Catalog CP-101, from Standard Parts Co., or Circle No. C29.

The New Controller Thread Root screw thread form is covered in a new folder that shows the difference between the old and new form and gives advantages of the new Hi-Life socket head cap screws. Write Standard Pressed Steel Co., for a copy, or Circle No. C30.

"Hardsteel" Operator's Manual contains valuable information on the techniques of drilling, countersinking, counterboring, reaming, and machining steels hardened by any method without first annealing the work with Black Drill's Hardsteel tools. It illustrates operations and tools and gives tables of drill sizes and speeds, and cutting speeds and feeds. Black Drill Co. supplies copies, or Circle No. C31.



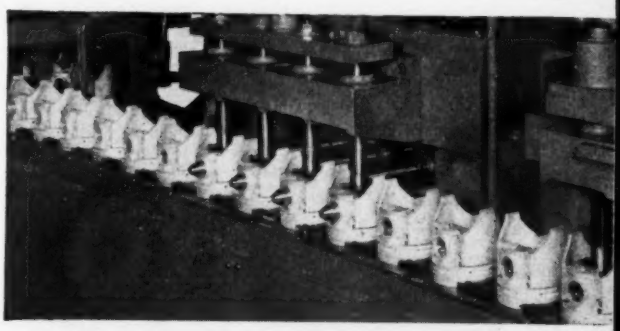
Special Alloys, such as Alfenol, Havar, and Elinvar Extra, are detailed in technical data bulletins which discuss the characteristics, physical constants, and heat treatment of these alloys. Contact Hamilton Watch Co., for your copy, or Circle No. C32.

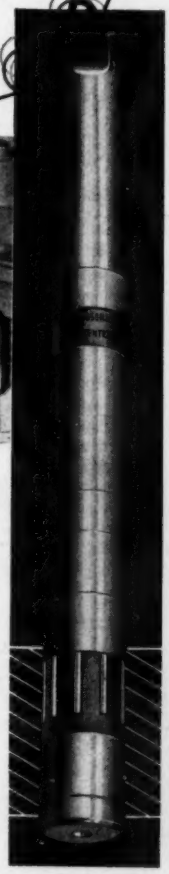
The New Issue of "Die Set Digest" describes the many activities of die set manufacturers that help die set users in their jobs. For your copy, write The Producto Machine Co., or Circle No. C33.

Material Shortages can be solved by using Meehanite castings, described in a catalog. Applications and advantages of these castings over other materials is given. Get a copy from Meehanite Metal Corp., or Circle No. C34.

"General Plate Products" describes solid and clad base metals and precious metals, thermostat metals, and electrical contacts. Get your copy from Texas Instruments Inc., Metals & Controls Div'n, or Circle No. C35.

4 PIECES in 8 SECONDS to .0002" 7 MICROINCHES





BEARINGIZING—the microsmooth finishing process—can put more life in your bearings at less cost. It work-hardens the surface to reduce porosity, and develops corrosion resistance.

For example, Cogsdill Bearingizers now finish aluminum piston wrist pin holes on the four-spindle automatic machine shown above, to accuracies of .0002" with measured finish of seven microinches—and better. The machine finishes four pieces every eight-second cycle; one set of rollers produces 25,000 holes.

For better finishes—O.D.'s or I.D.'s, get the Bearingizing story in the Cogsdill catalog.

Cogsdill
TOOL PRODUCTS, INC.
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CIRCLE INFORM-A-GRAM KEY NO. 79

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"57 T" automatically indexes the gang of saws, one row of teeth at a time. Also will grind either wet or dry.

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Easy as A B C:

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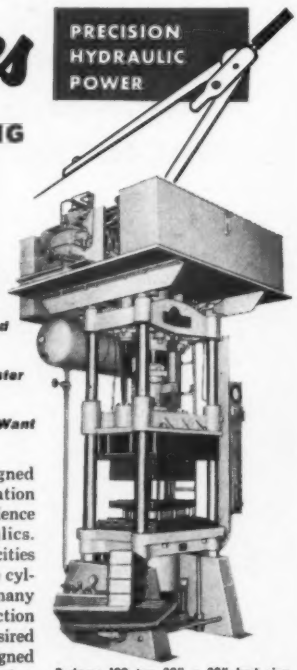
C — *Select Pump Unit and Controls To Give Speed You Want*



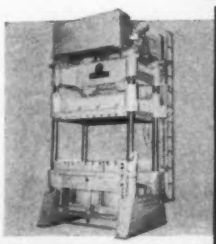
Rodgers 100 ton 30" x 30" bed size with complete one cycle automatic control for deep drawing.

The New Standard line of Rodgers Platen Presses has been designed to greatly simplify press selection. From the basic press styles, one may be selected and combined with varied pumps and controls, automatic, semi-automatic or pressure sensitive, to give the desired speed and performance. This results in savings of "custom" engineering and costs.

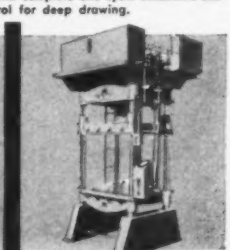
Rodgers Presses are designed and built by an organization with over 32 years' experience in high pressure hydraulics. They are available in capacities from 50 to 400 tons, single cylinder or twin cylinders, in many standard models for production or special uses. Where desired custom models will be designed to suit exacting special requirements.

SEND FOR *NEW* CATALOG 337...

This new Rodgers Catalog has complete specifications, tables and data, making it simple to determine the press for the job. Write for your copy without obligation.



Rodgers twin cylinder, twin die cushion 200 ton drawing press with 60" x 48" bed; single cycle automatic.



Rodgers 100 ton press, 36" x 36" bed with single lever pressure sensitive manual control.

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Catalogs . .

Interchangeable High-Pressure Hydraulic Cylinders are featured in a new catalog, which includes dimension charts, ordering data, and parts lists. Write The S-P Mfg. Corp., for your Guide 117, or Circle No. C36.

Production Tools, such as toolholders, automatic impact tools, fixture clamp cylinders, vises, and collets, are discussed in a catalog available from Burklyn Co., or Circle Inform-A-Gram No. C37.

Collet Closers for rotating hollow-spindle machines are explained in a bulletin. Installation and operation data is included. Write Wil-Numat Corp., for your copy, or Circle No. C38.

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5	15	25	53	69	84	721	893	941	962	1011	1044	1102	1132	1202
6	16	26	54	71	85	722	894	942	963	1012	1061	1111	1141	1211
7	17	27	59	73	100	761	895	943	964	1013	1062	1112	1142	1212
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10	20	30	63	77	107	801	912	951	981	1022	1092	1121	1153	
11	21	31	65	79	108	802	913	952	991	1023	1093	1122	1171	

EDITORIAL ITEMS

C1	C11	C21	C31	C41	P8	P18	P28	P38	P48	P58
C2	C12	C22	C32	C42	P9	P19	P29	P39	P49	P59
C3	C13	C23	C33	C43	P10	P20	P30	P40	P50	P60
C4	C14	C24	C34	P1	P11	P21	P31	P41	P51	P61
C5	C15	C25	C35	P2	P12	P22	P32	P42	P52	P62
C6	C16	C26	C36	P3	P13	P23	P33	P43	P53	P63
C7	C17	C27	C37	P4	P14	P24	P34	P44	P54	D1
C8	C18	C28	C38	P5	P15	P25	P35	P45	P55	
C9	C19	C29	C39	P6	P16	P26	P36	P46	P56	
C10	C20	C30	C40	P7	P17	P27	P37	P47	P57	

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6	16	26	54	71	85	722	894	942	963	1012	1061	1111	1141	1211
7	17	27	59	73	100	761	895	943	964	1013	1062	1112	1142	1212
8	18	28	61	74	103	762	896	944	971	1014	1063	1113	1151	1221
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C4	C14	C24	C34	P1	P11	P21	P31	P41	P51	P61
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C6	C16	C26	C36	P3	P13	P23	P33	P43	P53	P63
C7	C17	C27	C37	P4	P14	P24	P34	P44	P54	D1
C8	C18	C28	C38	P5	P15	P25	P35	P45	P55	
C9	C19	C29	C39	P6	P16	P26	P36	P46	P56	
C10	C20	C30	C40	P7	P17	P27	P37	P47	P57	

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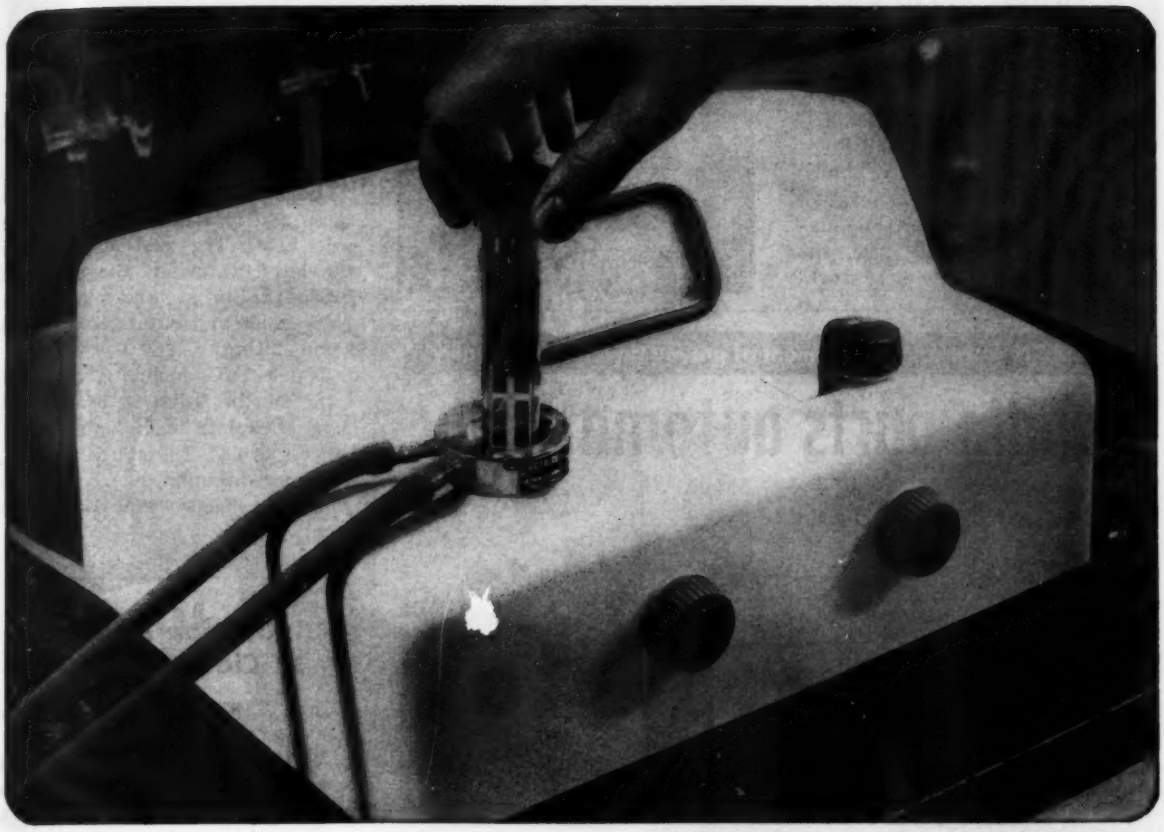
***Experience**—the added alloy in **Allegheny Ludlum** tool steels*



COLORIMETER (inherently extremely accurate) determines percentages of molybdenum, tungsten, cobalt and manganese in A-L tool steel to insure consistent, high quality.

Colorimeter measures exact chemical composition of Allegheny Ludlum tool steel melts

Accurate adjustment of alloys guarantees uniform heat treatment, predictable dimensional changes, reduced grinding, standardized machining operations.

Close control of molybdenum, tungsten, cobalt and manganese is at the heart of a good tool steel melt. In addition to the usual testing methods, Allegheny Ludlum's chemical laboratory checks these metals with Colorimetry because of its inherent, extreme accuracy.

On the basis of the Colorimeter's findings, it is possible to make carefully calculated furnace additions of ferro-alloys, insuring precise control over chemistry. This guarantees your receiving the *exact* analysis order after order, providing *uniformity of heat treatment, predictable dimensional changes, reduced grinding and standardized machining operations.*

Colorimetry is but one step toward careful control over composition. Allegheny Ludlum also sets exacting purchasing specifications on raw materials and scrap. Quality Control checks all incoming orders to see that they conform with these specifications. Another guard toward your getting your exact specifications: each ingot bears a metal tab showing heat number.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

ALLEGHENY LUDLUM STEEL CORPORATION. Oliver Bldg., Pittsburgh 22, Pa. Address Dept. TP-25

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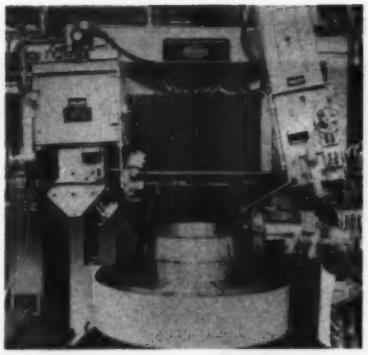
every grade of tool steel... every help in using it

CIRCLE INFORM-A-GRAM KEY NO. 83

Huge 'Special' Grinds 7' OD's

A huge vertical chucking grinder recently installed by The Timken Roller Bearing Co. is capable of grinding bearings with an OD of over 7'. Built by The Bullard Co., the grinder is 20' long, almost 15' high, and rests on a vibration insulated, steel reinforced foundation. Despite its great size, the grinder does extremely close work;



runout within 0.0002" has been attained on individual bearing cups, cones, or thrust raceways.

Designed for versatility, the grinder is equipped with three grinding heads, mounted on precision-made hydraulically-controlled slides. The right hand vertical head grinds the outside and inside diameters of cups and cones. The faces and ribs are ground by the side head. The vertical head on the left side grinds the complete profile of thrust raceways (raceway, inner and outer ribs) at the same setting.

The 84" OD magnetic chucking table can be fitted with a special magnetic plate to expand the diameter to 88". The chuck revolves in either direction over a variable range of speeds from 13.4 to 81 rpm.

SYNTRON cost-cutting equipment of proven dependable Quality

handle parts automatically

SYNTRON Vertical Vibratory

PARTS FEEDERS

* * * feed parts of almost every size, shape and material in oriented position to automatic marking machines, assembly units, hobbers, inspection machines and many other automatic operations.

Simplicity of design provides automatic operations with dependability, high rate of parts flow, instant finger-tip control and low maintenance.

Increase your parts handling with efficient, dependable SYNTRON Parts Feeders.

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TEST SIEVE SHAKERS

SHAFT SEALS

BATTERY CHARGERS

CIRCLE INFORM-A-GRAM KEY NO. 84

Induction Heating In Close Quarters

Into a 10' x 20' area, Induction Heating Corp. has installed a complete high frequency induction heat treating shop. It's able to process all hardening jobs for a printing equipment maker, from cams and gears to inking rollers up to 6' long and 10" dia.

This grouping shows a Ther-Monic two-position quench-type work station (left) for general purpose heating. In back of this is Ther-Monic radio frequency power transfer switchgear for transferring high frequency power to either the heating station or the vertical scanner station in the rear. At the right is the vertical scanning machine for progressively hardening all sizes of steel shafts from 4" to 6' long and up to 10" dia. The Series C induction generator is installed against the wall to save floor space.

STRIPPIT SUPER 30 FABRICATOR

Larger work sizes for more efficiency...for short run punching — 30" x any length ... for production run hole duplication — 25" x 30".

Adjustable table for greater accuracy and flexibility...for punching to closer tolerances in angles, shapes and formed parts as well as flat sheets.

New, no-jam electric head eliminates down time...and the need for pressurized air. Fewer parts minimize maintenance — ensure quieter, more positive operation.

Wide range of hole punching capacities...from a 3½" hole (round or shaped) in 16 gauge to a ½" hole in ¼" mild steel.

Corner and edge notching...up to 5" x 5" in 16 gauge mild steel — 90° corners, rectangular, vee, radii and special shape edge notches.

Straight line nibbling and contour shearing...at 165-strokes per minute in ⅛" mild steel. Instant changeover from single stroke punching.

New swing-shift punch holders...quick-opening, positive-closing — for right or left-hand operation. Electrical interlock for safety.

Exclusive quick-change tooling system...using standard stock punch and stripping guide assemblies and die buttons. Size changes take less than 20 seconds.

New quick-set gauging system...with micrometer settings for fast, accurate layout and rapid work positioning.

EASY CONVERSION TO A PRODUCTION PUNCHING UNIT...

with the Strippit Duplicator which can be built-in as an integral part of the Super 30 Fabricator — and the Dupl-O-Scope for punching Duplicator templates from a drawing, layout or sample part.

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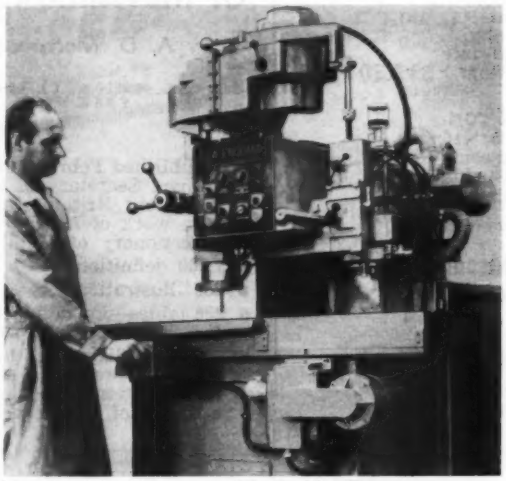
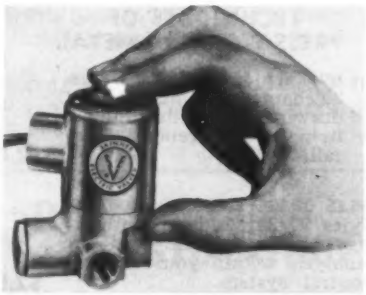
Product News

Automatic Profiler

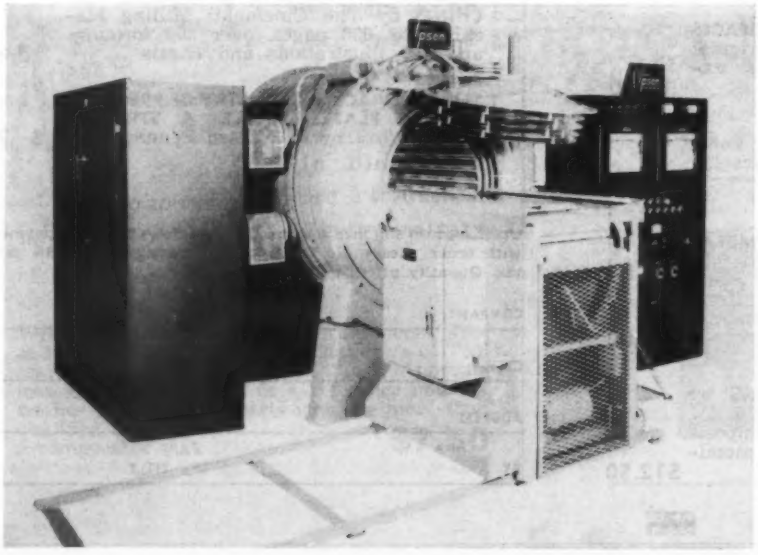


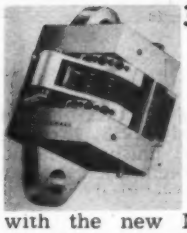
Especially designed for 360° profile milling under tracer control is the new automatic profiler, Magnetrace. It operates by following an easily prepared sheet steel template. Because of fast metal removal and fine finishes, roughing isn't necessary on many jobs and finishing cuts are completed in a single pass. Bulletin is published by Pratt & Whitney Co., Inc., Charter Oak Blvd., W. Hartford 1, Conn., or Circle No. P1.



Versatile Valves

New high-pressure models of the two-way Type R Series pilot-operated solenoid valves are designed for use with air, oil, water, and other common media. Get a bulletin from Skinner Electric Valve Div'n, Dept. RR168, 105 Edgewood Ave., New Britain, Conn., or Circle No. P2.





3-in-1 Marker

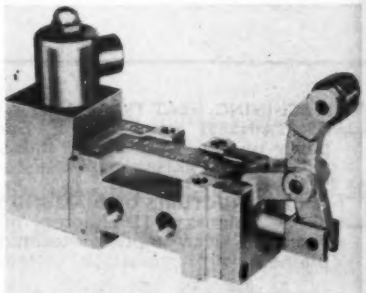
Automatic numbering, serial or model number, and trade name can be marked in one operation with the new Model 52 metal stamping machine. It's sturdy, accurate, and long lasting. Bulletin 52 is supplied by Numberall Stamp & Tool Co., Huguenot Park, Staten Island 12, N.Y., or Circle Inform-A-Gram No. P3.

Speedy Boring Tools

Especially designed for the needs of high surface speed jig boring in small bores, is this new carbide boring tool line. Application range is from 1/16" to 1" dia, and with standard boring tool holders. Ask Wetmore Tool & Engineering Co., 5320 E. Washington Blvd., Los Angeles 22, for details, or Circle Inform-A-Gram No. P4.

Spool Valves

A new series of spool valves features interchangeability of all operators on both ends of the body, availability of various types of



neutral position spools, and reduction of spare parts inventory. Automatic Valve Co., 37415 Grand River, Farmington, Mich., or Circle No. P5.

Heat Treating Furnace

Here's an automatic high vacuum cold wall-type furnace with 24" x 36" x 12" work space and 2275°F operating temperature. It's especially adaptable for copper and nickel brazing of flat stainless assemblies. Ipsen Industries, Inc., 715 South Main St., Rockford, Ill., or Circle Inform-A-Gram No. P6.

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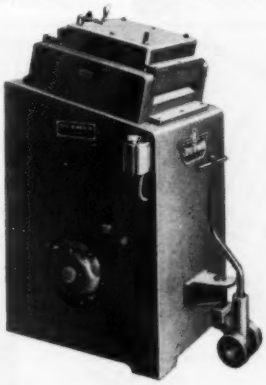

Flat, accurate stampings save hours of assembly time, work better and last longer where flatness is important to performance, paint and plate easier and look better.

Low cost Cooper Weymouth straighteners are fast, accurate, automatic, straighten small parts, coils or strips to .001" - .002". A unique two-point adjustment gives fast, easy, precise set-up. Machined steel housings, hardened and ground rollers and anti-friction bearings insure longest life. A 4 gear-train drive equalizes bearing loads, gives smoother high-speed operation. Self-contained and self-powered with variable speed controls, straighteners are available in bench-height cabinet or portable models, in four sizes.

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Product News

Accessories Cabinets

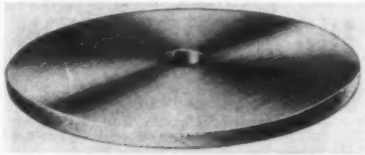
Gages, fixtures, and special tools that are used with jig borers and jig grinders all have their place in the new steel cabinets specially de-

signed for the purpose. Two models are available from Vidmar, Inc., 2323 Reach Rd., Williamsport, Pa., or Circle Inform-A-Gram No. P7.

Transfer Punch Set

For transferring location of threaded, drilled, and reamed holes, slugs, and blanks, use a new set of transfer punches. They're precision made of finest tool steel and carefully heat treated and tempered for long life. R. L. Spellman Co., Urbana, Ohio, or Circle Inform-A-Gram No. P8.

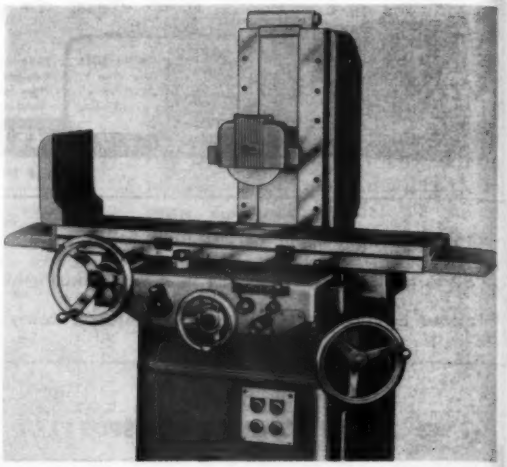
Swiss Cam Blanks



These Meehanite cam blanks for Swiss type screw machines are made to give excellent wear resistance without heat treating. They come in a number of shapes and sizes from American Cam Co., P.O. Box 2106, Hartford, Conn., or Circle No. P9.

New Surface Grinder

Here's a new surface grinder with 16½" vertical capacity from full 7" dia wheel to top of table. It has infinitely variable cross feed range from 0.005" to 0.250", with rapid traverse for dressing the wheel from the chuck or quick positioning the work. Get bulletin on No. 10H from Covel Mfg. Co., Benton Harbor, Mich. P10.



Compact Air Screwdriver

A new porting and valve design on the new compact air screwdriver creates better performance and reduces maintenance. The Super Atom utilizes a patented air motor that delivers 50% more power than the standard model with maximum expansion in either direction. Newage Industries, Inc., 222 York Rd., Jenkintown, Pa., or Circle Inform-A-Gram No. P11.

A New 26-Page Booklet, covering the Gisholt Masterline No. 12, 12V, and 24 automatic production lathes, completely illustrates each machine. Features, specifications, and accessories are included, and 25 actual job applications are shown in Form 1213 to demonstrate the versatility of these sturdy, economical machines. Gisholt Machine Co., or Circle Inform-A-Gram No. P12.

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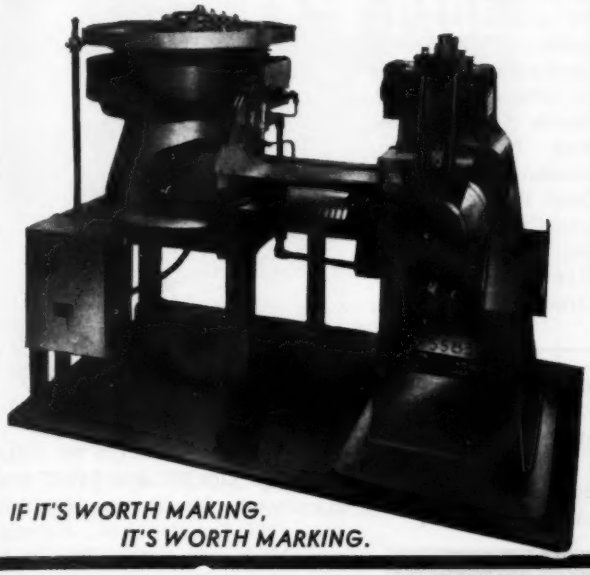
The Model 195-S With Hopper & Chain Conveyor Feed Will Knurl Cores, and Remove Forging Die Flash at The Rate of 4000 Per Hour



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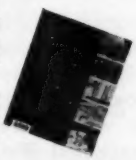

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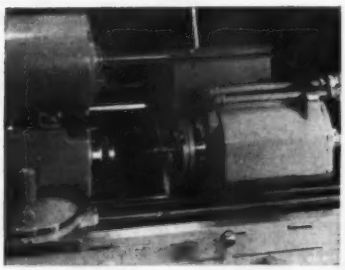
Product News

Inclined-Bed Lathe

Greater 17-3/4″ swing is a feature of the new Ensign 13″ lathe, available with 24″ and 36″ between centers. All-geared headstock offers up to 1500 rpm spindle speeds and spindle with 1-9/16″ bore. Brochure is available from Bentley Industrial Corp., 41 E. 42nd St., New York, or Circle Inform-A-Gram No. P13.

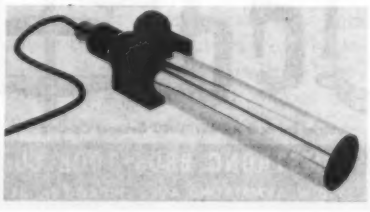
High Speed Grinder

A high frequency spindle, providing speeds up to 100,000 rpm, is offered on the standard Model 84 internal grinder. It's ideal for grinding small holes with tolerances of ±0.0004″ and improving cutting performance of small grinding wheels and carbide burrs. Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass., or Circle Inform-A-Gram No. P14.



Autocollimator

Designed to fit standard fixtures, this autocollimator features an interchangeable light source and eyepiece for viewing from end or side. It's capable of reading precise angles to 10 sec, has a power of 20, and a total useful field of 4°. Tinsley Laboratories, Inc., 2526 Grove St., Berkeley, Calif., or Circle No. P15.

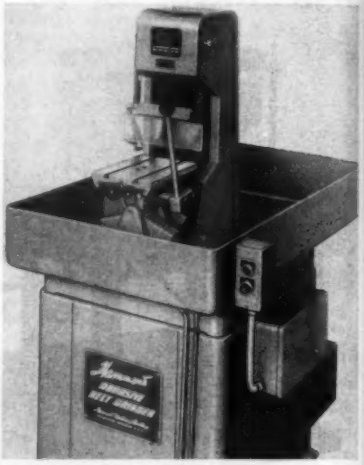


Plastic Repair Kit

Practical and economical repairing of floors, machinery, fixtures, etc. can be done with Plastic Mastic. The new epoxy-polyamide chemical compound, when cured, can be drilled and machined. Write Williamson Adhesives, Inc., 8220 Kimball Ave., Skokie, Ill., or Circle Inform-A-Gram No. P16.

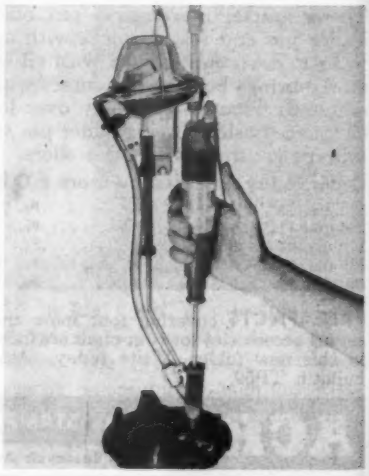
Abrasive Belt Grinder

A water-cooled and -lubricated platen is featured on the Hammond Model VH-6 abrasive belt grinder. Platens, chrome-faced for manual grinding and carbide-faced for semi-automatic grinding, are reversible top and bottom for maximum life. Get Bulletin 347-T from Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo, Mich., or Circle Inform-A-Gram No. P17.



Automatic Screw Feeder

Use this new automatic Zipp screw feeder, which can be used with all makes of pneumatic and electrical tools, to feed and position all types of screw fasteners. It eliminates manual screw placement and is best for production runs. Literature is available from Wales-Strippit, Inc., 212 Buell Rd., Akron, N.Y., or Circle No. P18.



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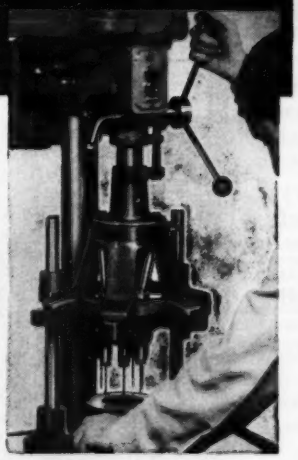

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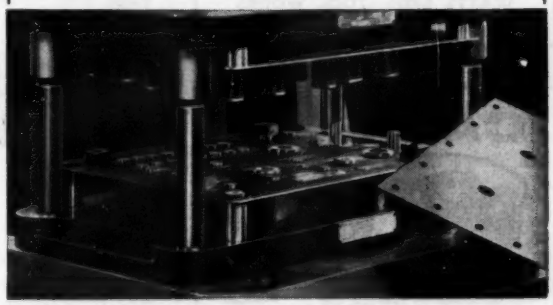

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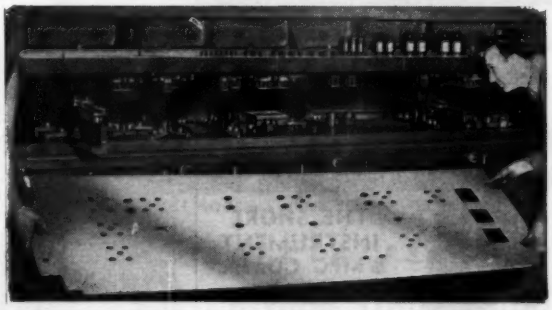
All parts reusable and interchangeable. Punches and dies stocked in .001" increments from .100" thru .500" dia. Larger sizes available.



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All parts reusable and interchangeable. Punches and dies stocked in .001" increments from .100" thru .500" dia. Larger sizes available.

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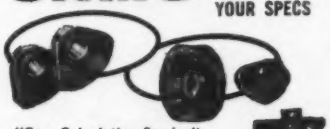

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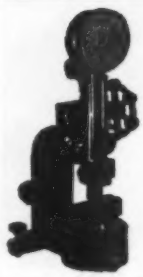

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CIRCLE INFORM-A-GRAM KEY NO. 945

Product News

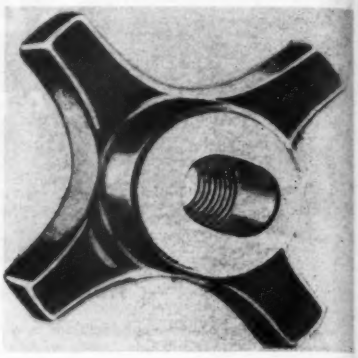
Versatile Indexing

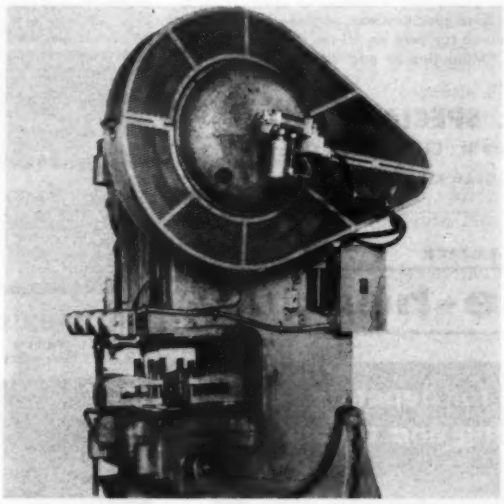
A new mechanical indexing rotary table, Versi-Table, can be set or individually adjusted for numerous index patterns between four and twenty-four stations. It

also features a skip station arrangement for skipping 1, 2, 3, or 5 stations each index. Bulletins available from The Lithibar Co., 345 W. 14th St., Holland, Mich., or Circle Inform-A-Gram No. P19.

Hand Knobs

Cast iron and aluminum quick-acting hand knobs are now available in five sizes with 1" to 3" ODs, and thread sizes from 1/4-20 to 5/8-11. Request bulletin from Northwestern Tools, Inc., 116 Hollier Ave., Dayton 3, Ohio, or Circle Inform-A-Gram No. P20.





New Torque Control Device

Before overloads occur, this new torque limiting device adjusts the amount of air pressure holding the clutch in engagement during the stroke cycle to avoid dangerous pressures. It's designed especially for presses with air clutches mounted on the crankshaft. E. W. Bliss Co., Press Div'n, 1375 Raff Rd., S.W., Canton, Ohio, or Circle No. P21.

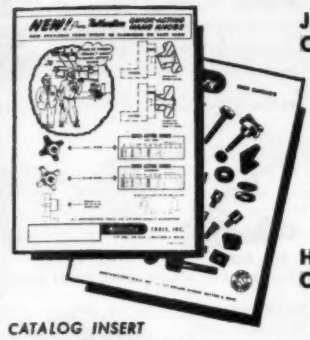
New Rack Cutters

Automatically and economically produce racks for all types of office, tool, and scientific machinery with this new line of Koepfer rack cutters. Two models are available: Model 205 and the 210 with one or two cutting heads. Single cutters or a gang of annular cutters are available. Write to Cosa Corp., 405 Lexington Ave., New York, for details, or Circle Inform - A - Gram No. P22.

NEW

ALUMINUM CAST IRON

QUICK-ACTING HAND KNOBS



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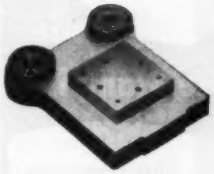
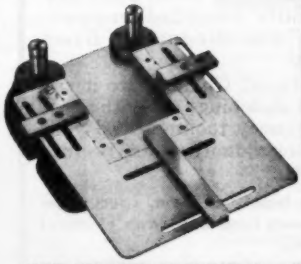
Punches and Dies

Notching Die with Gauge Table





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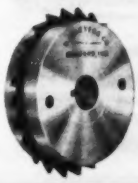

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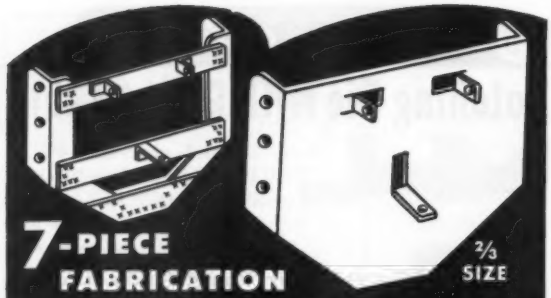

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Redesigned to 1-Piece Stamping

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BOKUM makes a STANDARD BORING TOOL for EVERY job

STYLE A
for general boring

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for bottoming and facing

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for internal threading

You name the job—and regardless of whether or not it is general boring, internal threading, internal chamfering or cutting O-ring grooves—you'll find that Bokum has a boring tool that is standard for that particular operation.

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Bokum boring tools are available in super high speed steel, carbide tipped or solid tungsten carbide. Next time you order—specify Bokum—get maximum accuracy and economy from the same tool.

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Insure perfect threads in blind holes

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for clean cut-offs without burrs

O-RING GROOVES—OR-103
15 stock sizes available

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Vises, Rotary Tables, Milling Attachments can speed up production, solve difficult angle jobs.

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Product News

Deep Hole Drilling

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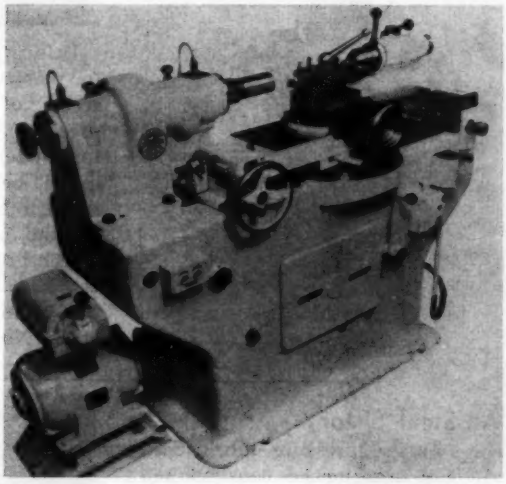
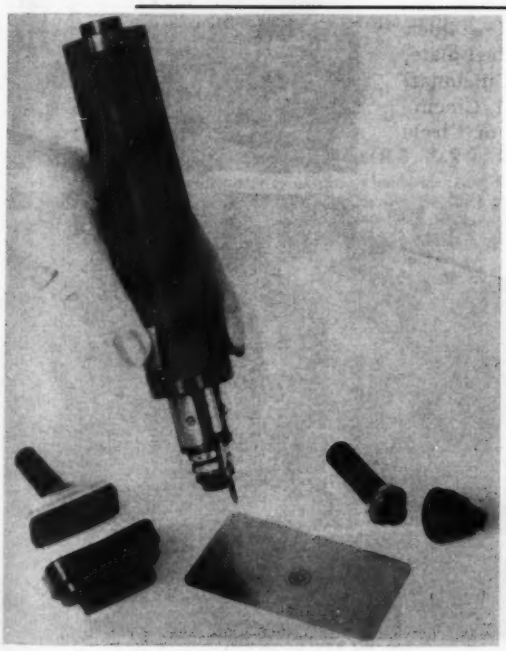
Super Finishes

A new precision diamond tool lathe is for production of turned surfaces of exceptional super finish and accuracy (from 2 to 5 micro-inches) and for correctness of cylinder form and accurate surface flatness. Ideal for non-ferrous metal machine components for assembly with mating parts. Milo Mfg. Co., 466 N. Broad St., Elizabeth, N. J., or Circle Inform-A-Gram No. P24.





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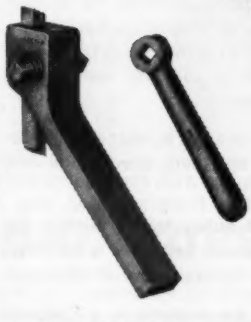

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Furnished with Cobalt Bits

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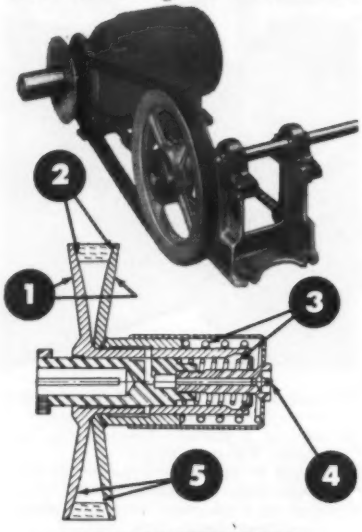
feature by feature...



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5 Curved pulley faces maintain full contact with belt sides at all times, greatly increasing overall efficiency.

Pulleys are available in a complete range of sizes, fractional to 15 hp.—full 3 to 1 ratio. Immediate delivery from stock.

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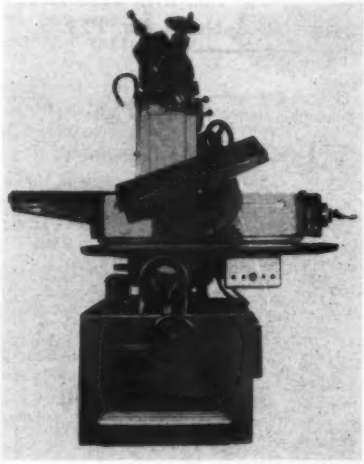
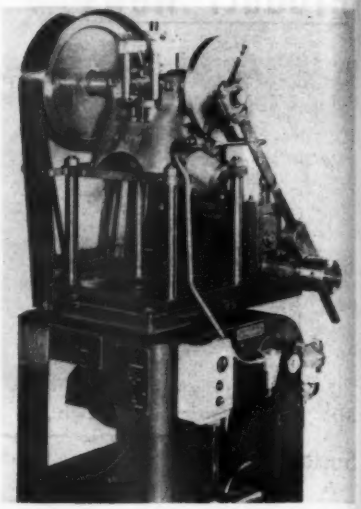
Product News

New Milling Machine

Suitable for toolroom or production applications is the new Model F4 Aciera milling machine. It features high precision, extremely rigid construction, hardened and ground gears and splines, interchangeable tables, and vertical or universal milling head. For information write Alina Corp., 122 E. 2nd St., Mineola, L.I., N.Y., or Circle No. P26.



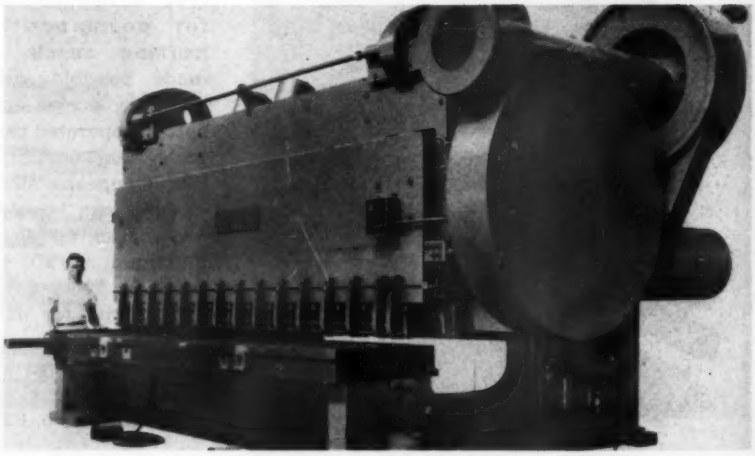
Trimming Press



Utilization of full press tonnage for die trimming is done by a new series of expanded bed Havir presses. Available in 8, 12, and 16 ton models with 12" x 12" and 12" by 14" beds. With larger bed area small tonnage presses can be used for the jobs previously requiring larger presses. Sales Service Mfg. Co., 2363 University Ave., St. Paul 14, Minn., or Circle Inform-A-Gram No. P27.

All-Steel Shear

Automatic pressure lubrication, all steel interlocked construction, and forged alloy steel eccentric shaft are features of the new Series 15014 shear. It has a 1¼" thick cutting capacity in mild steel plate, 14' long. Contact The Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, for information, or Circle No. P28.



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A RIGHT HAND TOOL
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NEW!
Resetting to Zero in Seconds. Quick Adjustable Tolerance Hands. HEAVY TUNGSTEN CARBIDE tipped Measuring Anvils. STAINLESS STEEL, one-piece spindle and screw, hardened with Ground Threads — Permanently Rustproof.

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INDICATING BENCH MICROMETER with NON-ROTATING Spindle
Range 0-1"
Cat. #40 MSP

ONLY $170.00 IN HARDWOOD CASE

Reading .000050" from dial.
Directly reading in .0001" from micrometer.
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Dull chrome finished.

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USE IT AS A COMPARATOR
Anvils RETRACTABLE for rapid repeat measurements.
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Adjustable Measuring Pressure to any desired tension.
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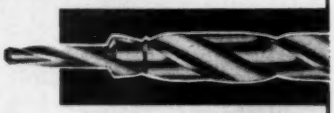

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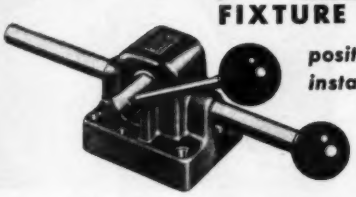
heinrich Grip-Master
FIXTURE LOCKS



positive clamping
instant setting

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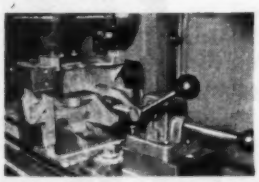
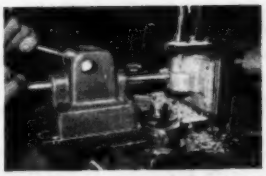
LONG TRAVEL provides plenty of chip clearance, easy loading and unloading. Gets into hard-to-reach places. Base sizes: Model 2FL, 3⅜" x 3¼"; Model 9FL, 4⅜" x 3⅜". Bar lengths from 8" to 18". Here are two examples of Grip-Masters speeding production in drilling and milling operations.





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CIRCLE INFORM-A-GRAM KEY NO. 992

in just 6 days* from now you can

complete protection against dirt, grime and wear for any moving part with

ELASTICONE® COVERS

Plan ahead . . . specify Elasticones by size and number on your next drawing—get automatic protection for shafts, bushings, lead screws, guide pins or hydraulic rams—wherever precision and lubrication must be preserved.

Elasticones are spirally wound flat alloy steel cones available* in standard sizes for immediate delivery. Write for complete information and new data sheet '58.

CENTRAL Safety Equipment Co.
6603 Marsden Street Philadelphia 35, Pa.

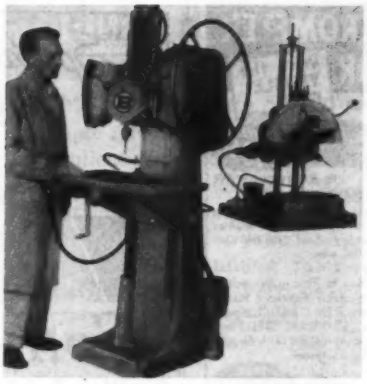
Distributors in principal cities

CIRCLE INFORM-A-GRAM KEY NO. 994

Product News

Two Turret Drills

Greater application is possible by using two new turret drill models that have the basic turret principle advantages. Model 0 drills up to 1/4" dia in steel and Model 1C, 1/2" dia in cast iron. For information, write The Burgmaster Corp., 15001 S. Figueroa St., Gardena, Calif., or Circle Inform-A-Gram No. P29.



A skilled craftsman uses a Foredom machine with a fine dental burr to finish off the carving of the earth's contours on the 6' 3" diameter, 3-dimensional epoxy globe designed and built by Geo-Physical Maps, Inc., NYC. The first of its kind, this globe sets a new standard for scholarly research and manufacturing techniques, and the finest tools available were chosen to execute the intricate detail involved.

all over the world...

FOREDOM FLEXIBLE SHAFT MACHINES

do the most intricate jobs... better!

Grinding & finishing • Buffing & polishing
Engraving & marking • Sanding & brushing
Tool maintenance • Mold & die work
Filing • Deburring

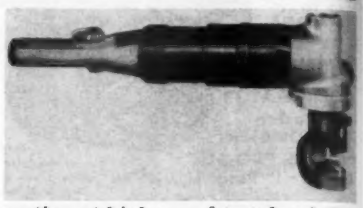
More and more craftsmen handle small precision jobs faster, better and easier with Foredom Flexible Shaft Machines – whether they work in metal, plastic, leather, rubber, wood or glass. They like Foredom's variety of slim handpieces which give perfect control at all speeds. Inexpensive, easily portable, these machines are ideal for both maintenance and production. For more information, write today for catalog 210-TP1

FOREDOM ELECTRIC COMPANY, INC.
BETHEL, CONNECTICUT

CIRCLE INFORM-A-GRAM KEY NO. 100

Heavy-Duty Nibblers

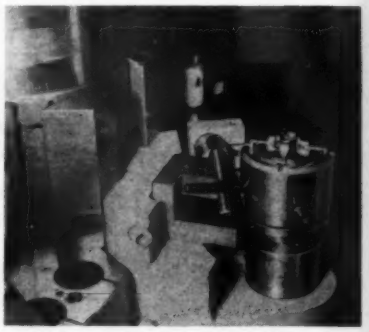
A new nibbler easily cuts through 8 ga mild steel or 10 ga stainless at 6 ft/min and leaves both edges of the cut free from distortion. It has a vertical punching



motion at high speed to take sharp, rectangular 1/4" wide bites out of the metal. Write Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1, Ohio, for details, or Circle Inform-A-Gram No. P30.

Resets Die Heads

A new hydraulic mechanism was designed to reset die heads automatically during operation of 2AB single spindle bar automatics. It handles up to 7½" dia heads and eliminates time consuming manual resetting. For details write The Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, or Circle Inform-A-Gram No. P31.



Precision Tapped Holes

The new Model 500A adjustable torque tapping attachment, ideal for high production or automated setups, accommodates fluteless or standard taps. Recommended maximum speed is 2000 rpm. Write Tapmatic Corp., 845 W. 16th St., Costa Mesa, Calif., for details, or Circle Inform-A-Gram No. P32.

GENESEE Carbide Tipped Inserted Blade Facing and Counterboring Tools

Interchangeable Pilots

Constant Chip Space Throughout Life of Blades

Standard Sizes 1¼ to 4 Standard with Straight or Morse Taper Shanks

Carbide Tipped H.S.S. Blades. Save 25% or more over cost of Solid Tools

• Consult our Engineering Dept. on your Inserted Blade Production Tool Problems.

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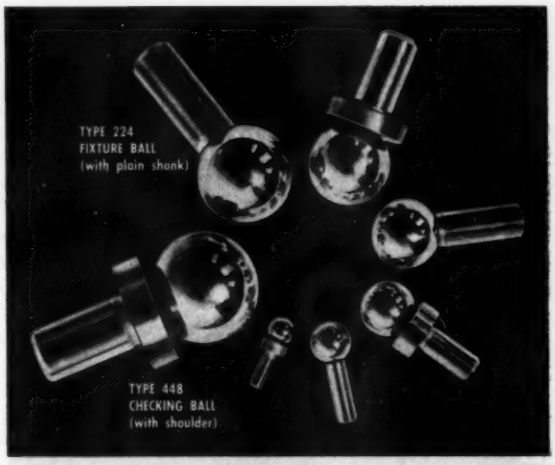
GENESEE MANUFACTURING COMPANY
566 HOLLENBECK STREET, ROCHESTER 21, N. Y.
Adjustable Hollow Mills • Facing and Counterboring Tools • Tube Deburring Tools • Special Production Tools • Since 1908

CIRCLE INFORM-A-GRAM KEY NO. 1011



TOOLING BALLS

- Durable; corrosion-resistant. Made of Type 440-C stainless steel, hardened to 55-58 Rockwell C.
- Highly accurate. Ball size held to ±.0001" for fixture balls; ±.00002" for checking balls.
- In stock: Types 224 and 448 in 7 ball sizes, ¼" to 1" by ⅛" steps; Type 348, with ½" ball and shouldered shank tapped 6-32. Other sizes to order.

WRITE FOR price list and ASTE Data Sheet

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MANUFACTURERS OF PRECISION BALLS AND BEARINGS
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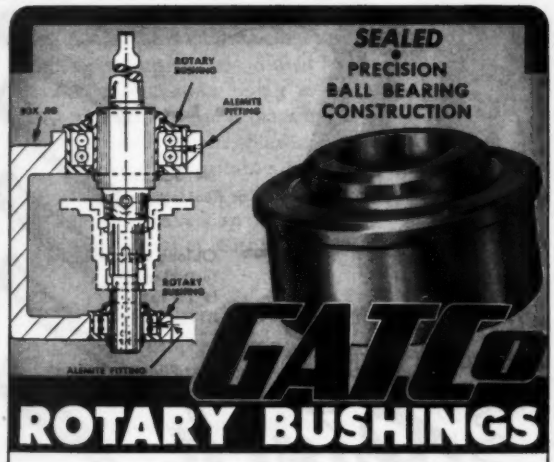
ANN ARBOR, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 1013



ROTARY BUSHINGS

For DRILLING, CORE DRILLING, ROUGH and FINISHED DRILLING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work — or both.

Eliminates expensive tool construction — Reduces tool wear — Prevents seizure and pilot breakage — Especially adapted where precision is required.

Write for full information and prices

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CIRCLE INFORM-A-GRAM KEY NO. 1012

free catalog

47-page catalog illustrating complete line of

ALLEN AIR
AIR CYLINDERS
AIR VALVES & CLAMPS
DIAL FEED TABLES

The cylinder of "distinction" shown above is a Factory Reject. Only straight rods available.

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CIRCLE INFORM-A-GRAM KEY NO. 1014

Lepel

HIGH FREQUENCY INDUCTION HEATING UNITS

The Lepel line of induction heating equipment represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for numerous industrial applications.

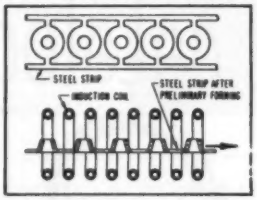
If you are interested in induction heating you are invited to send samples of the work with specifications. Our engineers will process and return the completed job with full data and recommendations without any cost or obligations.

TYPICAL INDUCTION HEATING APPLICATIONS

PLASTIC COATING OF TOOL HANDLES

A production line operation for coating handles of tools at Whitney Metal Tool Co., Rockford, Ill. uses induction heating with excellent results. The handles only are heated by induction to the desired temperature then dipped into a vinyl chloride base coating material for a short period depending upon the thickness of coating desired. The plastic coating formed on the handles is then cured by immersion in a carbo-wax bath.

FORMING OF METAL STRIP FACILITATED BY PROGRESSIVE ANNEALING



Metal forming operations which require intermediate anneals to restore ductility can be facilitated by induction annealing the strip progressively. Diagram illustrates this procedure for partially formed thin austenitic stainless steel strip. The induction annealing operation is scheduled in the production line between two press operations. Metal strip and wire of other materials are also induction annealed in this manner.

Electronic Tube Generators from 1 kw to 100 kw.
Spark Gap Converters from 2 kw to 30 kw.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE WOODSIDE 77, NEW YORK CITY, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1021

MISTKOP

STOPS MIST

COLLECTS MIST-FOG EFFECTIVELY IN A SMALLER SPACE

This efficient Mistkop unit provides low-cost mist control for all machining operations employing coolants or lubricants. Requires no duct work or costly piping—*is actually portable!*

Mistkop is sturdy in design—has a minimum number of parts and gives long, trouble-free service. Stops clouding of lights . . . eliminates fire hazards of uncontrolled mist. Write for detailed description.

AGET Manufacturing Company
1394 Church Street • Adrian, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 1022

The PUNCH WITH A Punch

Items shown here are stock. Usual shipment within 48 hours of order receipt.

Specials made to your specifications.

Send to Dept. A for catalog.

RING PUNCH & DIE
INCORPORATED
Jamestown, New York

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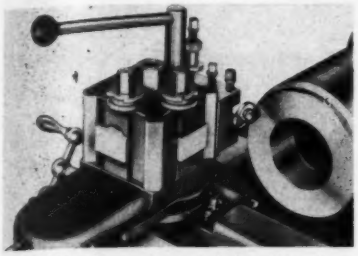
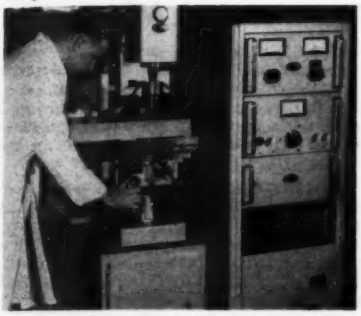
Quick Toolholder

Cut setup time using a new quick-change toolholder for lathes. The Master Multi-Tool is ideal for large production, short runs, or



individual work and takes light or heavy cuts with precision. Once it's set, it repeats again and again. For your bulletin, write Karl A. Neise, 404 4th Ave., New York 15, or Circle No. P33.

Impact Grinder



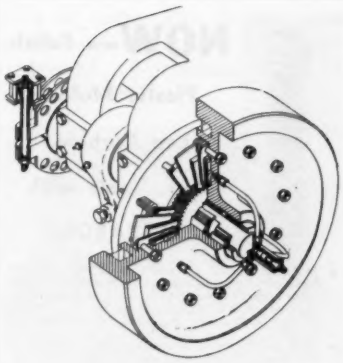
Cut areas up to 3½" dia in hard or brittle materials using a new 2,500 watt ultrasonic impact grinder. It operates within tolerances of ±0.0003" and is suitable for cutting, slicing, drilling, grinding, and trepanning. Raytheon Co., Waltham 54, Mass., or Circle Inform-A-Gram No. P34.

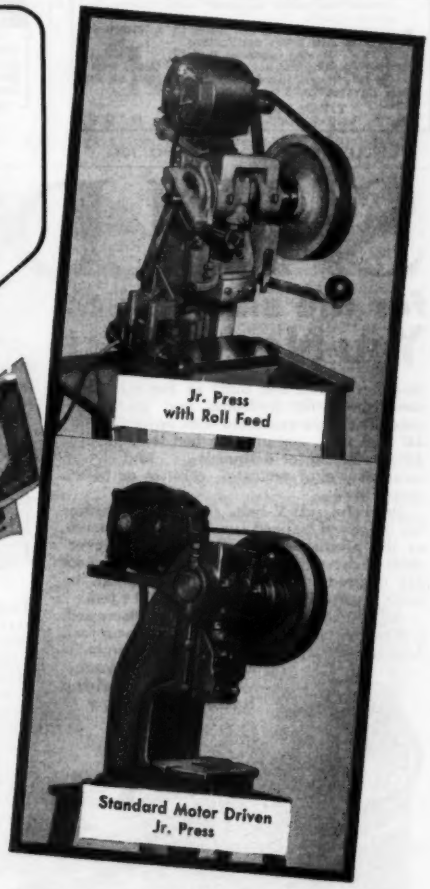
Contour Measuring Instrument

Fast, accurate dimensional checking of impellers, inducers, nozzles, turbine wheels, blades, and two and three dimensional cams is possible using the new Model SP-2 Contour-O-Scope. Up to 30" dia and 10" width can be handled. Contact TurboTronics Corp., 19360 Roseland Ave., Cleveland 17 for details, or Circle Inform-A-Gram No. P35.

Fast Acting Clutch

A new air-operated, electrically-controlled air clutch and brake, featuring fast action, smooth operation, and economy, allows press speeds to be increased without damage or shortened life. Shockless, instant starting and stopping are obtained with low air consumption. Service Machine Co., 2310 W. 78th St., Chicago 20, or Circle No. P36.

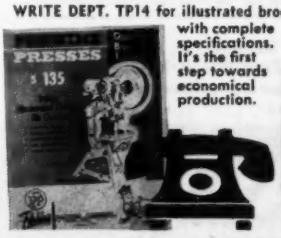




It is hard to find a small press that will equal the performance of Perkins Junior Press, for POWER, SPEED, ECONOMY, VERSATILITY and year-in-year-out DEPENDABILITY. Dollar-wise, they're the most economical press you can buy.

Perkins Presses are being profitably operated today in some of the largest metal working plants in the country. There's a model to fit your particular requirements.

WRITE DEPT. TP14 for illustrated brochures with complete specifications. It's the first step towards economical production.



PERKINS
MACHINE COMPANY
WARREN, MASS., U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 103

NOW—Polish Plastic Molds, Lap Carbide, Dies, Tools with TETRABOR.

- Tetrabor is an oil paste of boron carbide especially compounded for lapping carbide tools and dies; steel tools, dies and gages as well as polishing plastic molds. It closely resembles diamond in hardness and specific weight.
- CUT LAPPING COST—Tetrabor costs much less than diamond and can be used in 99 per cent of the applications formerly requiring diamond.
- INCREASE PRODUCTION — Faster acting Tetrabor permits its use in place of conventional compounds at same cost. Gives superior finish.
- Available in 100 gram tube in a range of grits to suit every application.

Dealer Inquiries Invited.

Order your trial kit containing a 50 gram sample of 12 grits. Shipped Post Paid for $15.50. Or send for free literature and price list.

TITAN TOOL SUPPLY CO.
Box L, 1419 Hertel Avenue, Buffalo 16, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 1041

NEW MAUSER VERNIER CALIPER

STAINLESS STEEL HARDENED THROUGHOUT
FULLY LUSTRO-CHROME SCALE AND VERNIER

For Outside, Inside and Depth
6-1/4" Measuring Capacity
Reading Lower Scale — .001"
Reading Upper Scale — .001"
Lower and Upper Vernier Plates are adjustable (up to .020") for easy recalibration and adjustment
New flush type Vernier eliminates reading parallax
Double length vernier for more accurate and faster readings
Fine Cam-lock adjustment for easy setting at close limits
Overall length 8-1/8"
$19.75

Cat. No. 193 furnished in clear unbreakable polyethylene case

For Complete Information request our 96 Page Catalog — Contact any of our 4 "Coast to Coast" Locations or your nearest Local Distributor.

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PRECISION MEASURING TOOLS AND INSTRUMENTS

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CHICAGO: 5045 W. Harrison, Chicago 44, Ill.
When writing to any of the above locations, refer to DEPT. E-1

CIRCLE INFORM-A-GRAM KEY NO. 1042

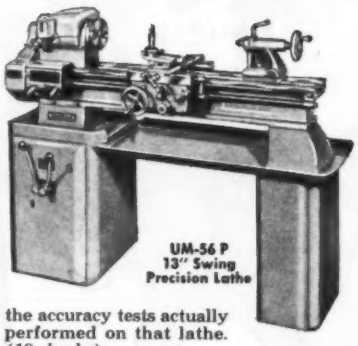
SHELDON Precision LATHES

for the size Lathes You Need Most

Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13"... in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

Powerful, all-V-belt, drive units—either the standard 8-speed (or 16-speed) E-drive; or the production favorite, a rapid, lever-shift U-drive. Where higher spindle speeds are desired, the standard E-drive can be built to provide speeds up to 2,000 r.p.m.

All Sheldon Lathes have handscraped, built-in precision. Each lathe is guaranteed to meet or surpass the American Standards for Toolroom Accuracy. With every Sheldon Lathe goes a copy of the accuracy tests actually performed on that lathe. (19 checks).



UM-56 P
13" Swing
Precision Lathe

Important optional features include: hardened bed ways, L00 Long Taper Key Drive spindles, 4" D1 Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.

The new Sheldon-built Sebastian Geared Head Lathes have greatly increased work capacity and many advanced features. These include a wide, heavy, hardened and ground bed . . . easy shifting spindle speed dial . . . 60-pitch gear box . . . independent drop lever apron clutches . . . cam-action tailstock clamp . . . and, automatic lubrication in the headstock and apron with "1-shot" lubrication of carriage.

Sheldon-Built
Sebastian 13" and 15" Geared Head
Precision Lathes

SHELDON
Horizontal Milling Machine

SHELDON
12" Shaper

SHELDON MACHINE CO., Inc.

Builders of Sheldon Lathes, Milling Machines, Shapers and Sebastian Lathes.

4235 North Knox Ave. • Chicago 41, Ill.

Send in coupon or write for catalogs and names of nearest Sheldon and Sebastian Distributors where you can see these new lathes in operation.

SHELDON MACHINE CO., INC.
4235 North Knox Avenue, Chicago 41, Illinois

Gentlemen: Please send new catalogs describing:

☐ Sheldon ☐ 10", ☐ 11' ☐ 13" Lathes
☐ Sebastian 13" and 15' Geared Head Lathes
☐ Horizontal Milling Machine ☐ Name of Local Dealer
☐ Sheldon 12" Shaper ☐ Have representative Call

Name ..... Title .....
Company Name .....
Street Address ..... ☐ Company ☐ Home
City ..... State .....

CIRCLE INFORM-A-GRAM KEY NO. 1043

Gaertner Toolmakers' Microscope used to measure typical piece part. Co-ordinate range 4" x 2".

Precise measurement to 0.0001" and 1 min. of arc

Gaertner Toolmakers' Microscope

Here is a reliable, easy-to-use microscope for precise measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. Ideally suited for making a wide variety of precision measurements and is especially valuable in reducing rejects in production work.

With the Gaertner Toolmakers' Microscope you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear. It is a basic measuring instrument for inspection depts., gage labs, tool and die and model shops, industrial and research labs.

The Gaertner Toolmakers' Microscope has been proven in use by U. S. Government Gage Laboratories, and by prime contractors and their subcontractors. With all parties using the same measuring instrument, inspection procedures are co-ordinated and disagreements and rejects minimized.

Features that help you get
HIGH SETTING AND REPEATING ACCURACY

- Low, compact built-in rotary stage reads to 1 minute of arc throughout 360° range.
- Minimum overhang of stages.
- Full 2" precision-lapped lead screws with correction device.
- Straightforward, direct, uncomplicated optical system.

Features that assure you of
EASY, CONVENIENT OPERATION

- Independently rotatable cross hairs in protractor ocular speed up measurements, simplify measuring procedure.
- Convenient location of ocular eyepieces for ease of reading.
- Built-in transformer and plugs for all illuminators.

Modifications and accessories to
MEET YOUR EXACT REQUIREMENTS

- Thread and radius templates, camera and spotting attachments, fine motion focus, variable magnification available.
- If you have a special measuring problem, our staff of representatives will be happy to consult with you. The service and engineering facilities of the manufacturer are always immediately available to help you.

Write for Bulletin 147-56

Designed and manufactured by

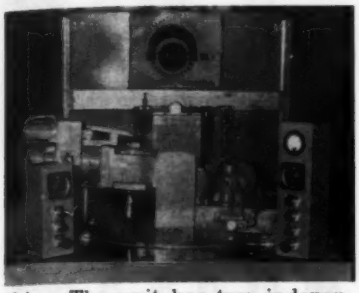
The Gaertner Scientific Corporation

1242 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335

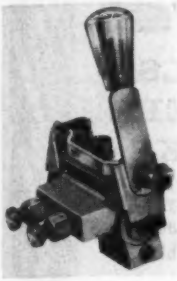
CIRCLE INFORM-A-GRAM KEY NO. 1044

Deburring Machine

For low production of a multiplicity of parts and/or high production of a single component, use the new MM-2 high speed Model 3000 deburring and finishing machine. The unit has two independently operated spindle heads and a capacity of up to 6" dia, and 240 pcs/hr production. Write for information to The Mecha Finish Corp., Sturgis, Mich., or Circle No. P37.



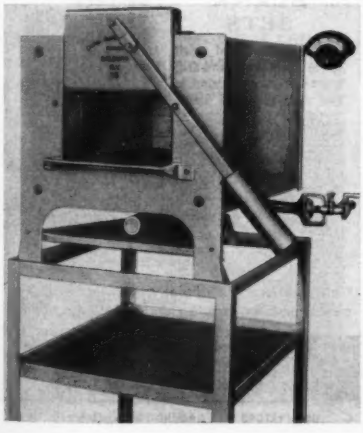
Easy Adjustment Control



A new 4-way air control valve features speed of operation and has a built-in speed control that allows easy adjustment of both the forward and reverse cylinder stroke. This bleed-type valve can operate at pressures as low as 1 psi. Cleveland Pneumatic Industries, 64 Old Orchard, Skokie, Ill., or Circle Inform-A-Gram No. P38.

Bench-Type Furnace

A new heat treating furnace has a cast iron venturi burner with modernized port design which takes reflected heat to speed up operations, and a new hearth mix which provides greater resistance up to 2000°F. For literature on Model 55, write Charles A. Hones, Inc., 2473 Grand Ave., Baldwin, L.I., N.Y., or Circle Inform-A-Gram No. P39.



New Wire Cup Brush

Faster cutting and easier cleaning at speeds up to 7,000 rpm are possible with the new 6" cup brush with a turret back. The brush also features a rolled bead edge, internally mounted nut, and two full rows of tufts. For details write Anderson Corp., 1029-1039 Southbridge St., Worcester, Mass., or Circle No. P40.

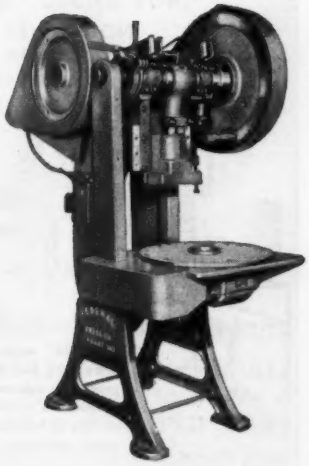
Modern FEDERAL Dial Feeds give you

automation at less cost!

—eliminate specialized and more costly equipment!

Federal Dial Feeds are your answer to greater production at lower costs. Equipped with special jigging, automatic feeds and ejectors, their applications are virtually unlimited and the need for specialized, more costly equipment often eliminated. (Example, one manufacturer increased production 600%.)

Add Federal's quality features and workmanship . . . and you've got a winner. Investigate Federal Dial Feeds for your operations. Gear or chain driven with cam-type indexing mechanisms. Sizes range from 6 to 80 tons.



No. 7 Dial Feed
Gear Driven. Capacity, 80 tons.

FEDERAL PRESS COMPANY
907 Division St., Elkhart, Indiana

No. 3 Dial Feed
Chain Driven. Capacity, 26 tons.

FEDERAL DIAL FEED PRESSES
33 Years' Experience in Dial Feed Engineering and Construction

CIRCLE INFORM-A-GRAM KEY NO. 105

ETALON INGAGE

measures the exact BORE or blind hole size!

Reading: .0001"

Size: 3/16" to 4"

Takes accurate measurements of blind holes. No masters or setting rings—measures directly—by .0001".

Automatic alignment, rectangular contact points guarantee extreme accuracy even when fully extended. Immediately detects out of round holes; with extensions measures holes up to 6 feet deep. Hardened contact points exert minimum pressure—will not damage fragile work.

Easy to read, deep graduations on a large diameter thimble. Dull chrome plated. Furnished in English or Metric graduations, individually, or in sets.

WRITE FOR CATALOG on complete line of precision measuring instruments: VERNIER CALIPERS, MICROMETERS, DIAL INDICATORS.

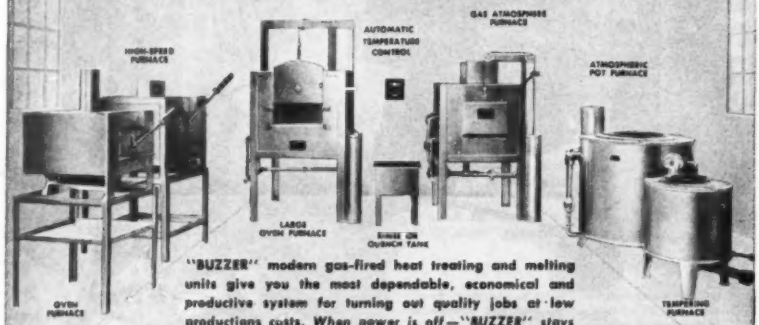
ALINA CORPORATION
122 East Second St.
Mineola, L. I., N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1061

MORE HEAT TREATING VOLUME

with BASIC "BUZZER PACKAGE"

NO BLOWER OR OTHER POWER NEEDED
. . . just connect to gas supply



"BUZZER" modern gas-fired heat treating and melting units give you the most dependable, economical and productive system for turning out quality jobs at low productions costs. *When power is off—"BUZZER" stays on the job!* Standard and special furnaces, large or small, available to equip your shop to exact requirements.

COMPLETE LINE OF BUZZER REG. U.S. PAT. OFFICE BURNERS FOR CLEANING, RINSING, PICKLING AND SUNDRY HEAT OPERATIONS

WRITE TODAY FOR NEW "BUZZER" CATALOG

CHARLES A. HONES, INC.

HEAT TREATING EQUIPMENT SPECIALISTS SINCE 1911
153 S. Grand Avenue, Baldwin, L. I., N. Y. • BAldwin 3-1110

CIRCLE INFORM-A-GRAM KEY NO. 1062

Highly polished flutes produce smoother, more accurate holes!

It pays to specify

ACE

DRILLS REAMERS BLANKS

Premium Quality High Speed Steel, Carbide Tipped and Solid Carbide.

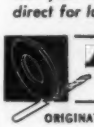
DRILL SETS

Fractional, Wire and Letter size drill sets packed in convenient folding index cases.

BLANK SETS

Uniformly hardened high speed steel reamer and drill blanks precision ground to new close tolerance limits.

Call your local distributor today—or write Ace direct for latest catalog and price information.



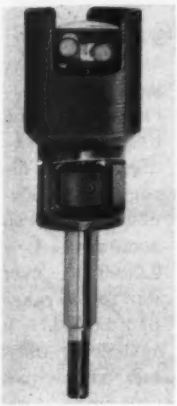
ACE DRILL
Adrian, Michigan

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

CIRCLE INFORM-A-GRAM KEY NO. 1063

Burr-Free Grinds

A new treatment for grinding wheels retards loading and functions as a dry coolant. Dri-Kool coating promotes burn-free, burr-free dry grinding of high speed steels, and longer wheel life with less frequent dressings. For bulletin, write King Graphite Products, Inc., 21950 Telegraph Rd., Trenton, Mich., or Circle No. 41.

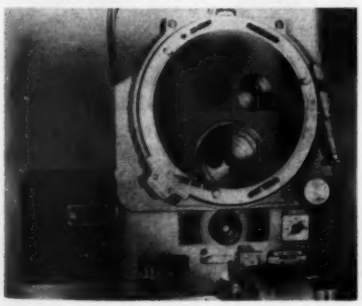


Hole Locator

The indicator of Model CC-100-V is axially centered and recessed in the gage head so the indicator is read directly in line with the hole being checked. The pilot member remains stationary while a knurled thumb knob rotates, for less wear to the pilot. For details, write Mayes Tool Co., 26514 W. 7-Mile Rd., Detroit 40, or Circle Inform-A-Gram No. P42.

Reflection Device

This new reflection inspection device is designed to produce the maximum amount of reflectivity, regardless of the surface finish of the part being inspected. Even superficial surface scratches can be checked accurately. It's excellent for deep-hole inspection, as shown.



Jones & Lamson Machine Co., Springfield, Vt., or Circle P43.

Bench-Type Balancers

Miniature belt-, air-, or electrically self-driven parts or assemblies can be checked by this new line of high speed bench-type balancers. Both horizontal and vertical models check miniature armatures, aircraft and missile gyros, and small spindles. They quickly and accurately measure and locate unbalances causing work support movements greater than 0.000002".

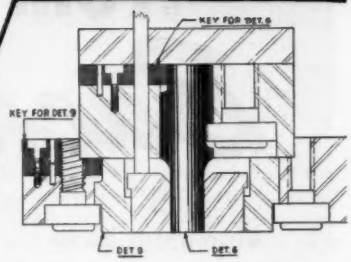
Get a bulletin from Gisholt Machine Co., Madison 10, Wis., or Circle Inform-A-Gram No. P44.

NEW
HOVIS KEY-ALIGNED DIE
THE LATEST ADDITION TO OUR STANDARD UNITS

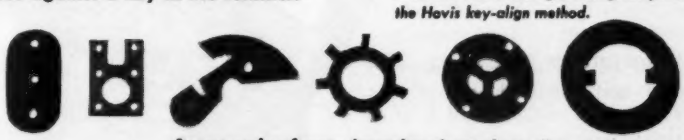
a must for irregular stampings

ELIMINATES ALL SET-UP ERRORS AND INSURES UNINTERRUPTED ACCURACY

When producing irregular shaped stampings, it is important that the cutting members of the die are located in the proper radial alignment. Hovis has introduced the key-aligned die to meet this requirement . . . With the key-aligned die any press operator can install the inserts without the possibility of misalignment. This is accomplished with a flat on the insert which locates against a key in the retainer.



A section line drawing showing the principle of the Hovis key-align method.



An example of some irregular pieces these dies produce by merely purchasing special sets of parts on which we are glad to quote

Made in 6 sizes:
¾"-1½"-2½"-4"-6"-8"

HOVIS UNIVERSAL COMPOUND DIES

for producing WASHERS and SMALL STAMPINGS . . . No need to make a NEW DIE for every STAMPED PART

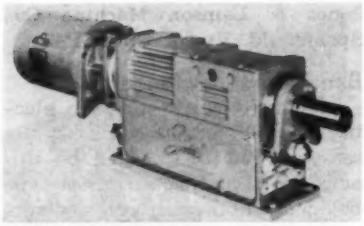
By simply removing and replacing five, small, interchangeable inserts a new part may be produced . . . This method makes possible all production including irregularly shaped pieces and shallow draws.

HOVIS SCREWLOCK COMPANY
8100 E. NINE MILE ROAD • BOX 97 • WARREN, MICHIGAN
Phone: Slocum 7-4800 Suburb of Detroit
CIRCLE INFORM-A-GRAM KEY NO. 107

Product News

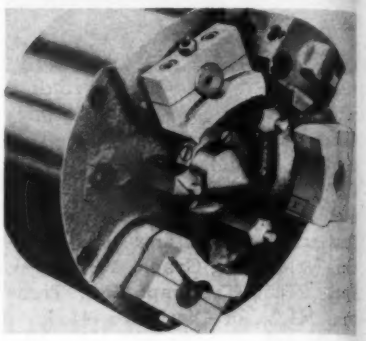
Automatic Drill Units

Featuring air-hydraulic operation, this new Model 17-400 drill unit is versatile and adaptable and adjusts quickly for rapid advance, length of feed, rate of feed, and total length of stroke. The Hartford Special Machinery Co., Hartford 12, Conn., supplies bulletins, or Circle Inform-A-Gram No. P45.



Power Chucking

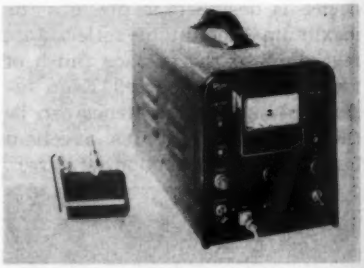
Greater accuracy and rigidity in high production is assured with this new principle in power chucking. The Ball-Lok power chuck with ball joint actuation which affords pull back action against fixed work stops, resulting in greater accuracy and rigidity in chucking parts, is primarily a single-purpose chuck for use on multi-spindle turning or boring operations. N. A. Woodworth Co., 1300 E. 9-Mile Rd., Detroit 20, or Circle Inform-A-Gram No. P46.



Accurate Gaging Head

This fully jeweled comparator gaging head, Supramess, reads directly in 0.000-020″ and has an accuracy of ± 0.000010″ over its total range of ±0.001″. It features constant measuring pressure, fully jeweled shockproof movement, and instant fine adjustment. Get a folder from Mahr Gage Co., 274 Lafayette St., New York 12, N.Y., or Circle Inform-A-Gram No. P47.

Spot Checker



This electronic comparator spot checks dimensions of small parts during production. The unit can be installed in a fixed position or carried from job to job. Write Radio Corp. of America, 30 Rockefeller Plaza, New York 20, or Circle Inform-A-Gram No. P48.

Husky lightweight from Buck

15″
Aluminum body
GIBBED KEYWAY
Ajust-Tru® Power Chuck

only 145 lbs.
(40% less than steel)
starts easier . . .stops easier . . . less brake wear

Guarantees precision within .001″

Gibs under jaws take up wear to TRIPLE useful precision life

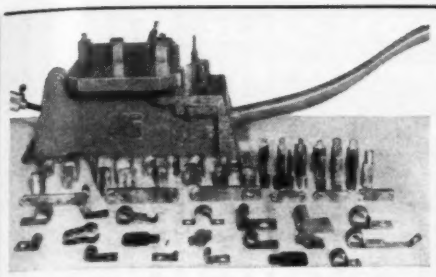
All working surfaces are Hardened, Ground, and Lubricated

Write for complete details

You make money every time you chuck with Buck

BUCK TOOL COMPANY
118 SCHIPPERS LANE • KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 108



Multiform

BENDER-CUTTER

CUTS, BENDS, PUNCHES

Available in hand, air or hydraulic models. The MULTIFORM is shipped complete with full assortment of dies and mandrels to form and cut round or flat stock up to ¼" x 1½" as illustrated. Punching dies available. Other models up to ½" x 8" hydraulic operated. Ideal for steel rule die forming.

WRITE FOR DESCRIPTIVE CIRCULAR

ALSO AIR OPERATED MODELS

J. A. RICHARDS COMPANY KALAMAZOO, MICH.

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HARDENED and GROUND HSS BLANKS

Any decimal diameter — any length. Mirror finish surface to gage tolerance.

Many uses —

—core pins, punches, gages, ejector pins, insert pins, special tools, etc. — Quick delivery.

Write or phone DRexell 6-4223 for price list D-3

WILLIAM T. HUTCHINSON CO.
53 Brown Ave., Springfield N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1092

Tomco INC.

HAND WHEELS

Straight Type Offset Type

SPECIALS

- HAND KNOBS
- MACHINE HANDLES
- HANDLES
- BALL HANDLES
- LEVERS
- SPECIALTIES

GRADUATED DIALS

SPECIFY TOMCO FOR DEPENDABILITY

A Complete line of high grade hand knobs, levers, handles, hand wheels, graduated dials is available for immediate shipment from stock of standard items. Specialty items made to your specifications.

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Tomco INC.
RACINE 2, WIS.

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WALLS TU-WAY BELT SANDER

Full 1/3 h.p. G. E. Motor

USE IT EITHER WAY

HORIZONTAL

VERTICAL

At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use $89.95

Illustrated Literature on Request

A few desirable distributor territories still available.

WALLS SALES CORPORATION
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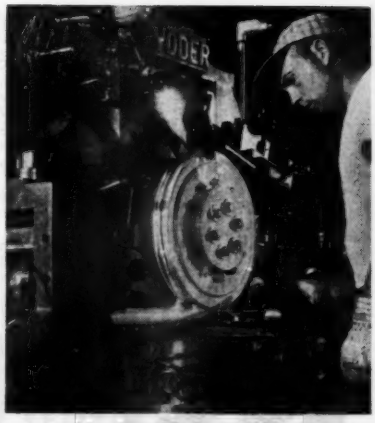


Yoder Tube Mills speed tailpipe production at AP Parts Corporation

The AP Parts Corporation (Toledo, Ohio), world's largest producer of replacement mufflers and tailpipes, uses 2 YODER Tube Mills to produce more than *300* ft. of 1¾", 1⅞" and 2" tubing per minute.

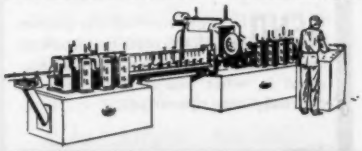
According to Mr. John Grindle, Plant Engineer, the two-man operated YODER Mills are vital to the production of the entire plant. "YODER Tube Mills earn their keep daily. They are easy to set up, maintain and operate ... the welds are clean and uniform. We depend on them for constant quality, high production and minimum downtime".

The YODER Tube Mills at AP Parts exemplify the production economies and dependability of all YODER-built equipment, whether it be Pipe and Tube Mills, Cold Roll-Forming Machinery or Slitting Equipment.

If your products require ferrous or non-ferrous pipe or tubing, from ¼" to 26" diameters, there is a YODER Mill designed to produce it economically, accurately and efficiently.

For complete information on YODER Pipe or Tube Mills ... write for the fully illustrated, 88 page YODER Tube Mill Book ... it is yours for the asking.

THE YODER COMPANY
5501 Walworth Avenue • Cleveland 1, Ohio



ENGINEERING YODER MANUFACTURING

PIPE AND TUBE MILLS
(ferrous or non-ferrous)

CIRCLE INFORM-A-GRAM KEY NO. 1095

*Of course, it's tough to toe such a fine tolerance line! But Acme Industrial has produced scores of parts, big and small, that meet just such exacting requirements . . . and we're talking about high volume output! America's missiles, dependent on thousandths-of-an-inch accuracy, incorporate many Acme-made parts. To lay it on the line, very, very few production lines have the number and variety of machines . . . the more-than-a-decade experience . . . the proved reputation for Nth degree production ability. These unique Acme capabilities can work for you.

Whatever the manufacturing job . . .
• valve and sleeve assemblies
• carbon assemblies • housing assemblies
• seals • nut assemblies—to list a few
. . . Acme's jobbing division does it best.

ACME INDUSTRIAL COMPANY
204 North Laflin, Chicago 7, Ill.

SEND... your new-off-the-presses FREE facilities book to me. I'd like to see what your equipment is, what you've done, how it can help our operation.

Name_____
Firm_____
Address_____
City_____ Zone____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 1101

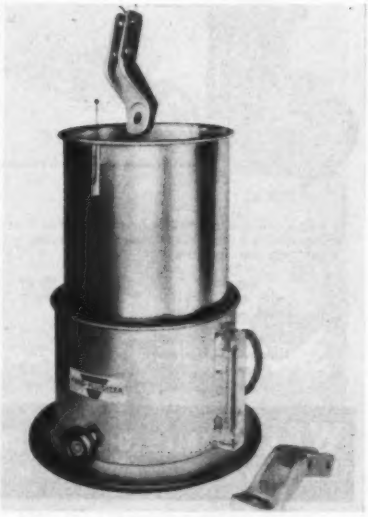
Product News

Ball Screw Actuators

A unique internal bypass for recirculating the balls is featured on these new ball screw assemblies with up to 0.0002″ per foot pitch accuracy. Efficiency is 90% or better and power requirements are lower. Contact Special Products Div'n, Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, for details, or Circle No. P49.

Easily Coat Parts

A new Vibro-Fluidizer for coating parts by the fluidized-bed process, which consists of dipping a pre-heated part into the coating material for a few seconds, has been announced. The coating material, securely bonded to the part, forms a tough impact and abrasion resistant dielectric hide. Armstrong Products Co., 347 Argonne Rd., Warsaw, Ind., or Circle Inform-A-Gram No. P50.



*Acme industrial figures your time is money. So . . . Acme saves it for you. The FREE Lock Screw Locating Jig instantly gives location for lock screw drilling and tapping. Handy? You bet. Free? Honest. A daily time and work saver? Certainly. No, Acme bushings (all 30,000 sizes of them) aren't free, too. But just as important, they're close as your nearby Acme distributor. Fastest delivery standard . . . finest quality (a tradition) expected . . . dependable precision remarkably perfect.

ACME INDUSTRIAL COMPANY
204 North Laflin, Chicago 7, Ill.

SAVE... my time and work! Send me a FREE Lock Screw Locating Jig. No obligation, of course.

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CIRCLE INFORM-A-GRAM KEY NO. 1102

IMMEDIATE DELIVERY OF CONTOUR CUTTERS For Standard Hydraulic Fittings... *In Stock*

AND 10050 Port Cutters

Turret Lathe and Drill Press Series: Carbide Tipped, integral reamer

Economy Series: Carbide Tipped, integral end pilot

Versatile Series: Carbide Tipped, interchangeable end, pilot and reamer

High Speed Steel Series: Integral end pilot, Super H.S.S.

"MS" Port Cutters

External Flat Form Tools

MS 33514: Carbide Tipped integral end pilot

MS 16142 "SAE": Carbide Tipped interchangeable end pilot and reamer

MS 33656 E and G; MS 33657E and S Stocked in Carbide Tip and H.S.S.

MS 33514E; MS 33515E and S Stocked in Carbide Tip and H.S.S.

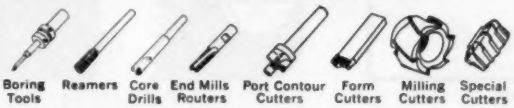
Wetmore stocks the fullest line of Port Contour Cutters and Flat Form Tools for Standard Hydraulic Fittings to assure fast delivery. Where required, modification of standard contours can usually be made within 48 hours.

For Special Cutting Tools, Wetmore offers the finest design and manufacturing facilities backed with extensive experience to combine operations and also to machine "problem parts."

Write for NEW Free Catalog.

Wetmore Tools

Wetmore Tool and Engineering Co.
5320 E. Washington Blvd., Los Angeles 22, California



Boring Tools | Reamers | Core Drills | End Mills Routers | Port Contour Cutters | Form Cutters | Milling Cutters | Special Cutters

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America's largest selection of economically priced PRESS ROOM EQUIPMENT

Die Set Pullers, 3 Sizes from $18.

Combination Coil Cradles & Straighteners, 11 Mdls fr. $2450

Durant
TOOL COMPANY
17 Thurbers Avenue
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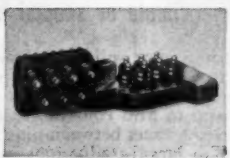
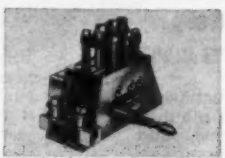
Write for new, free catalog detailing a complete selection of motor driven Scrap Choppers, Stock Reels, Coil Cradles, Stock Oilers and Roll Feeds . . Over 100 necessary pieces of equipment for the modern press room.

Our nearby representatives will be pleased to be of service to you without obligation.



Wire Straighteners, 5 Models from $160.



Standard Stock Straighteners, 13 Models from $310.

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DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead
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THE REMARKABLE MARKER • • • FOR REMARKABLE PRODUCTS

MATTHEWS *Airgrit*®

Marks gently permanently on

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ALUMINUM
GLASS
PLASTICS
CERAMICS
CARBIDE
BAKELITE

"Airgrit" marks the hardest, most polished surfaces with not much more than a breath of air.

Send a sample of your product to be "Airgrit" marked.

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PITTSBURGH 13, PA.

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WORLD'S LARGEST SELECTION OF
DECIMAL REAMERS and COUNTERBORES

WHY BUY SPECIALS
WE STOCK Thousands by the THOUSANDTHS!

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TWENTIETH CENTURY MFG. CO.
Box 429 TP Libertyville, Illinois
In emergency Telephone Libertyville 2-4200

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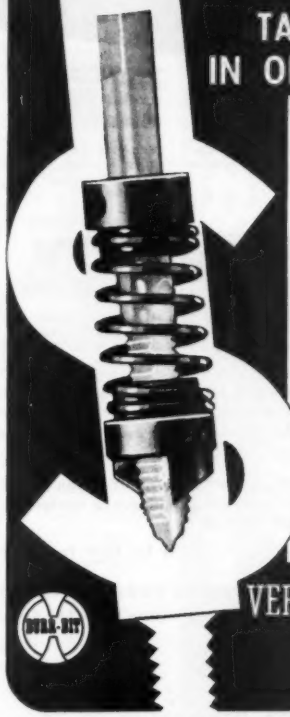
Two for One
TAP & DEBURR IN ONE OPERATION



Just slip Burr-Bit on any make tap—holes are deburred automatically, leaving a smooth, clean chamfer.

1 set-up—
1 operation—
instead of 2!

Burr-Bit by Vernon Devices is made of the finest quality high speed tool steel. It fits all 2, 3 and 4 flute taps, and can be used on almost any material.

Write for complete data and learn how you can save on your tapping operations. Dept. TP-1

VERNON DEVICES, Inc.
481 East 3rd Street
Mount Vernon, N. Y.
MOunt Vernon 4-1686

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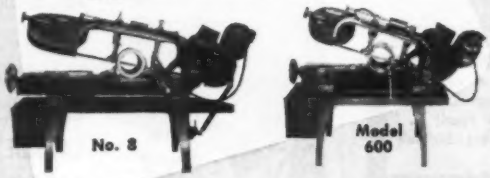
Simple Design...
Rugged Construction



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The simple design and rugged construction of every "Wellsaw" didn't just happen. We planned it that way! Over 30 years of specialized band saw experience and know-how is your assurance of the quality and service with each machine produced by Wells Manufacturing Corporation.

There is a Wells Saw of the right style, capacity and speed to do a better, more economical job for you. Wells Saws will deliver long, dependable service. Operating and maintenance costs are very low. See your Wells Distributor.

Wellsaw
Wells

The Pioneers of Horizontal
METAL CUTTING BAND SAWS
WELLS MANUFACTURING CORPORATION
1940 Cedar Street • Three Rivers, Michigan

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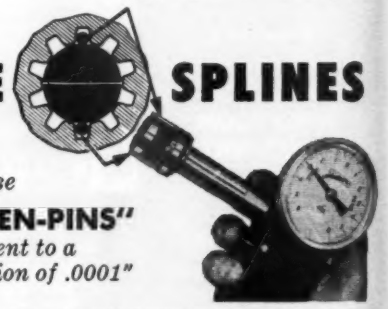
At last . . . a simplified way to

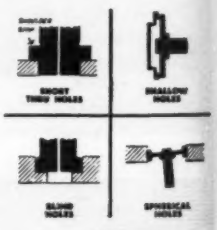
GAGE SPLINES



with precise
"BETWEEN-PINS"
measurement to a fraction of .0001"

COMTORPLUG with interchangeable expanding plugs to gage simple or special holes from ⅛" to 10" dia.

Insert into your spline or internal gear the unique expansion plug equipped with gaging wires . . . let it expand to firm contact . . . and you see the exact between-pins size shown in large graduations easily readable to a fractional tenth. For simple as well as special holes, Comtorplug's "automatic-accuracy" gaging has won a place in the production control set-ups of hundreds of fast-moving programs. *See why —request 8-page illustrated bulletin.*



COMTOR CO.
82 Farwell Street, Waltham 54, Massachusetts

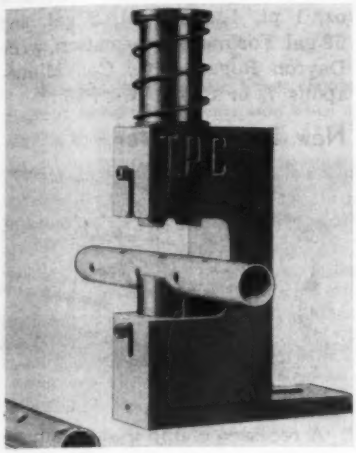
REQUEST BULLETIN 50

CIRCLE INFORM-A-GRAM KEY NO. 1124

Product News

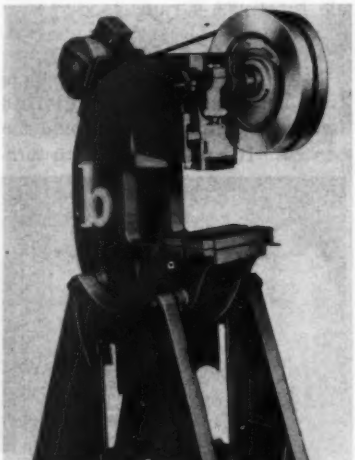
Tube-Piercing Unit

Using this tube-piercing unit, one press stroke perforates one hole or two opposed holes. Holes don't have to be the same diameter or configuration and no mandrel is required. Arrange any number of the units in a press for multiple punching. Tool Products Corp., 377 Old Falls Blvd., N. Tonawanda, N.Y., or Circle No. P51.



Power Punch Press

For jobs requiring unusual vertical or horizontal die space use the new Series 90 8-ton power punch press. Three shut heights with standard 1-1/4" stroke are available. It has a 8" x 11" bed

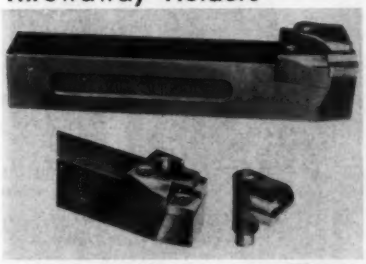


area and 12" clearance between center of slide and frame. Get details from Benchmaster Mfg. Co., 1835 W. Rosecrans Ave., Gardena, Calif., or Circle Inform-A-Gram No. P52.

Finer Pitch Knurls

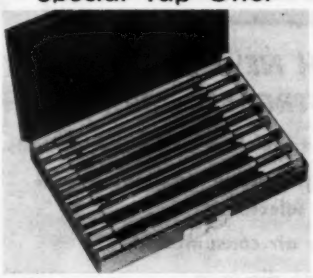
A new hand knurling tool offers 30-pitch as well as 20-pitch knurls. It's provided with three hardened steel knurls in straight or diamond pattern that are interchangeable for different patterns. Handles from 1/8" to 1" dia. Get information from Rockwin Mfg. Co., 80 Magnolia Ave., Westbury, L.I., N.Y., or Circle No. P53.

Throwaway Holders



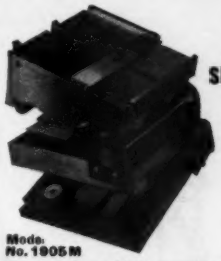
The simplified new Wesson T-A (throwaway) toolholders have only two major sub-assemblies — the shank assembly and the chipbreaker and clamp assembly. Individual components are designed so the more perishable parts are the least complicated and least costly to replace. It's designed for maximum strength and minimum overhang. Get details from Wesson Co., 1220 Woodward Hts Blvd., Ferndale 20, Mich., or Circle No. P54.

Special Tap Offer



During January and February the Walton Co. is offering a set of their tap extractors free with a purchase of #9 set of tap extensions, Style B. For details, get Folder 9666 from The Walton Co., Box 5, Elmwood Branch, Hartford 10, Conn., or Circle No. P55.

MAGNETIC SINE PLATES



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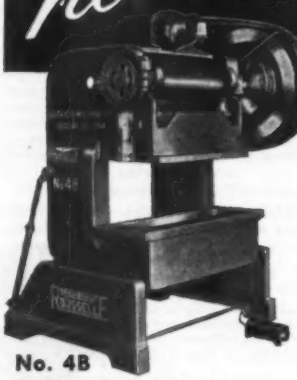

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Product News

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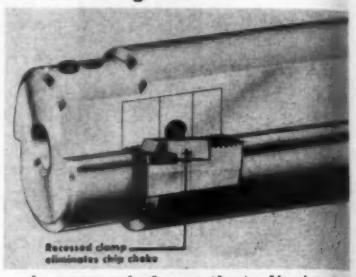
Six different container sizes of layout fluid are now available for stock shipments. Sizes include 4 oz, 1 pt, 1 qt, 1 gal, 5 gal, and 55 gal. For more information, write Dayton Rogers Mfg. Co., Minneapolis 7, or Circle No. P56.

New Boring Cutter



A recessed clamp that eliminates chip-choke and a wider adjustment range than other cutters are features of a new boring cutter. It uses throw-away tips and its strong body retains the efficiency imparted by double point cutting. Get details from Vee Bee Mfg. Co., 2632 Park St., Muskegon, Mich., or Circle Inform-A-Gram No. P57.

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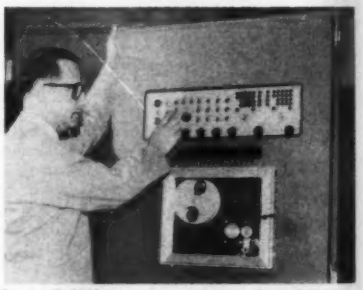
Save tooling and machining time using the new transistorized, two-axis numerical machine tool control. It can be used with turning, drilling, punching, riveting, or spot welding, and boasts high speed positioning at 180 ipm. Repeatable accuracy is 0.0002". Write Hughes Aircraft Co., Culver City, Calif., or Circle Inform-A-Gram No. P53.



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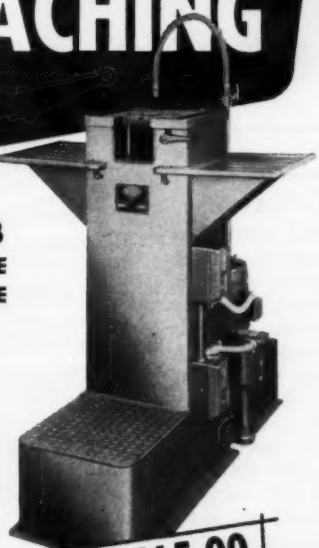

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3 MODELS

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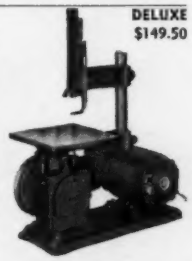

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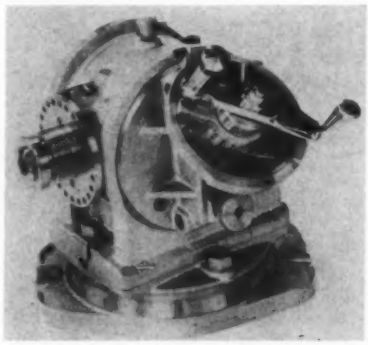

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Short, sturdy flutes for maximum rigidity are featured on these new drills for high strength aircraft and missile materials. The new point design provides maximum penetration rate and the new

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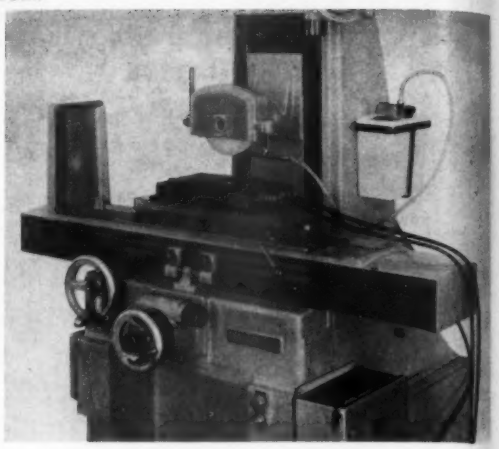
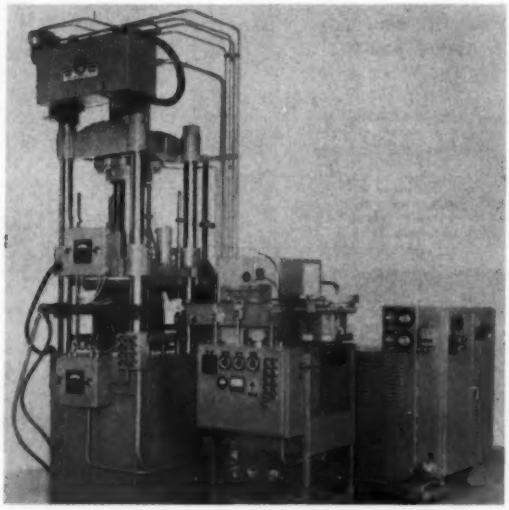
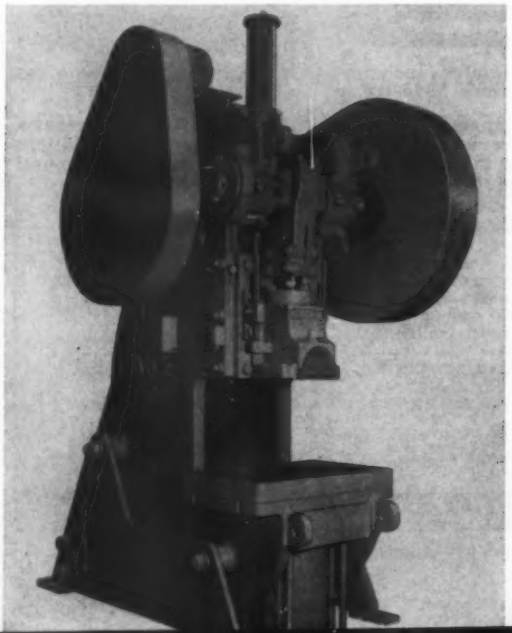
Use a small production model for a new electrostatic chucking system for a precision surface chucking of non-magnetic metals and non-conductors. The inexpensive unit, with 5" x 8" work-holding surface, is ideal for experimental shops, toolrooms, and for short-run production. Bulletin available from Electroforce Inc., Fairfield, Conn., or Circle Inform-A-Gram No. P63.



Automatic Molding



A newly designed line of automatic transfer and compression plastic molding machine features top and bottom hydraulic ejection systems, and positive air "hold down" or "hold up" to keep parts in desired portion of the mold. The pre-heater loader feeds a controlled number of preforms to the transfer pot on any 100, 150, 200, and 300 ton available units. For information, write Rodgers Hydraulic Inc., 7401 Walker St., Minneapolis 26, or Circle P64.



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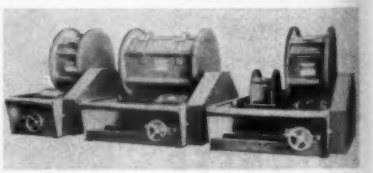

changeable barrel sizes of 2 qts, 0.5, and 1.1 cu ft capacity are available from Rampe Mfg. Co., 14915 Woodworth Ave., Cleveland 10, or Circle Inform-A-Gram No. P65.

Measure Small Parts

A non-rotating spindle is featured on the new Super-Comparator bench micrometer that's designed for measuring small, delicate parts. It has a range from 0-1" and the indicator reads directly in 0.000020". Get a folder from Mahr Gage Co., Inc., 274 Lafayette St., New York 12, or Circle Inform-A-Gram No. P66.

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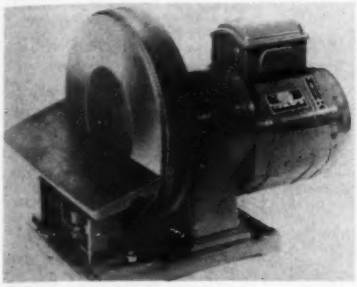

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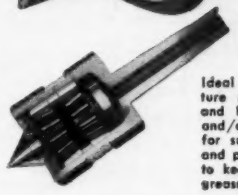

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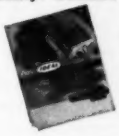

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CUMULATIVE EDITORIAL INDEX FOR 1959 ISSUES

TOOLING & PRODUCTION Magazine

SUBJECT INDEX

Air Power
Air cylinders, integral construction, advantages of, Jan., p. 51 (3 pp)
Timing and sequencing of cylinders, June, p. 49 (3 pp)

Assembly
Automatic parts feeding for, March, p. 47 (3 pp)
Brazing, with automatic equipment, Aug., p. 46 (1.33 pp)
Hydraulic press-welding of motor laminates, Oct., p. 68 (2 pp)
Joining missile tube assemblies by brazing, Sept., p. 60 (3 pp)
Stainless steel tanks, of, Oct., p. 49 (2.6 pp)
Welding, to tight specs, Aug., p. 49 (2 pp)

Automation
Assembly and testing, Aug., p. 46 (1.33 pp)
Controls for automated line, June, p. 55 (1 p)
Effective, benefits of, Apr., p. 37 (2 pp)
Grinding, of universal crosses, Aug., p. 72 (1.5 pp)
Small lot shop, for, Jan., p. 39 (1½ pp)

Bending
Draw bending missile tubes, Sept., p. 60 (3 pp)
Economical fixtures for, June, p. 47 (2 pp)

Carbide
Bonded to steel by powdered metal, Oct., p. 52 (1 p)
Choosing the lubricant for, June, p. 62 (1 p)
Grinding clinic, electrolytic, July, p. 60 (1.83 pp)
Spindle, construction of, Feb., p. 124 (1.6 pp)
Tool housekeeping, Feb., p. 45 (2.65 pp)
Tools, electrolytic grinding of, Feb., p. 42 (1.39 pp)
Tools, electrolytic grinding of, Feb., p. 43 (1.61 pp)
Tools, evaluation of, Feb., p. 37 (4.5 pp)

Castings
Malleable iron, advantages and design of, Apr., p. 44 (2.51 pp)
Miniature investment, process for, June, p. 66 (1 p)

Clamping
Air, on profiling machine, March, p. 66 (.6 p)
Electrostatic, Apr., p. 40 (.61 p)

Control
Automatic machines, chart for timing and sequencing components of, June, p. 49 (3 pp)
Automatic, for transfer line, June, p. 55 (1 p)
Electronic tracer drive cuts machining time, Feb., p. 51 (2 pp)
Machine tool, computer-less equipment for, Apr., p. 48 (1 p)
Magnetic tape, die sinking costs reduced by, Jan., p. 58 (1 p)
Numerical, for machine tools, Nov., p. 33 (1 p)
Numerical, in industry, July, p. 9 (1.5 pp)
Peg Board, for milling, Nov., p. 40 (1 p)
Tape, automatic welding by, Jan., p. 54 (1 p)
Tape, for small lot shop automation, Jan., p. 39 (1½ pp)
Tape, for turret press, Dec., p. 38 (1 p)
Tape, with tool changing, March, p. 50 (1 p)

Cost Cutting
Drilling operations combined for, Apr., p. 49 (1.91 pp)
Effective automation for, Apr., p. 37 (2 pp)
Steel rule dies, for, March, p. 65 (1.4 pp)
Tool grinding, electrolytic vs conventional, by, Feb., p. 42 (1.39 pp)
Welded pole pieces, redesigned for, June, p. 59 (2 pp)

Cutting Tools
Carbide, choice of lubricant for, June, p. 62 (1 p)
Ceramic, European uses, Nov., p. 37 (3 pp)

Cylinders
Air, integral construction, advantages of, Jan., p. 51 (3 pp)
Timing and sequencing of, graphic design method for, June, p. 49 (3 pp)

Dies
Color coding, for safety, Oct., p. 58 (2 pp)
Magnetic tooling for, Dec., p. 47 (3 pp)
Mechanized unloading of, Feb., p. 49 (2 pp)
Plastic, for drawing, Oct., p. 64 (1 p)
Progressive, "built backwards," Oct., p. 43 (3.3 pp)
"Shimmy," for shell trimming, June, p. 45 (2 pp)
Steel rule, building of, March, p. 65 (1.4 pp)

Drilling
Automated, at DeVilbiss, Dec., p. 53 (3 pp)
Ganged drill presses cut costs, Apr., p. 49 (1.91 pp)
Gun, of plastics, Sept., p. 66 (2.49 pp)
Gun, requirements for general purpose, July, p. 54 (2.75 pp)
New production techniques, Feb., p. 55 (4 pp)
Throwaway-tipped core drills, with, Dec., p. 50 (1 p)

Economics, Industrial
Cost of a man-hour, Sept., p. 51 (2.5 pp)
Depreciation an element in investment decisions, Feb., p. 11 (2.5 pp)
Equipment leasing, Sept., p. 51 (1.6 pp)
Foreign competition, Aug., p. 33 (1 p)
Foreign competition and American ingenuity, Oct., p. 26 (1.8 pp)
Foreign trade, effect of European Common Market on, June, p. 21 (.85 pp)
Inflation, competition, and depreciation, Aug., p. 7 (1.16 pp)
Machine replacement, common sense approach to, Nov., p. 35 (1.5 pp)
Machine replacement form, Sept., p. 78 (.7 p)
Modernization and expansion, Sept., p. 49 (2.4 pp)
Nomographs for determining lot size, Sept., p. 53 (3 pp)
Obsolescence factors, Sept., p. 47 (2 pp)
Tax saving techniques, Sept., p. 44 (2.85 pp)
Value analysis, Sept., p. 39 (1.7 pp)

Fixturing
Aluminum tooling plate, with, June, p. 58 (1 p)
Ceramic for high temp tooling, June, p. 43 (2 pp)
Economical, for bending, June, p. 47 (2 pp)
Low cost for power saws, Apr., p. 41 (2.66 pp)
Vacuum, for thin castings, Apr., p. 47 (1 p)

Forming
Cold, of ID's, Oct., p. 63 (1 p)
Explosive, status of, May, p. 67 (.86 pp)
Hot, of steel plate, Aug., p. 54 (3 pp)
PH steels, modifications for, Oct., p. 72 (2 pp)

Gages
Accuracy and control of, for current needs, Apr., p. 6 (1.5 pp)
Effect of new international inch on, June, p. 39 (1 p)
Systematic control of, Jan., p. 41 (4 pp)

Gears
Optical inspection system for, Jan., p. 60 (1 p)

Grinding and Finishing
Automatic, of universal crosses, Aug., p. 72 (1.5 pp)
Centerless, Norton's new machine, Aug., p. 66 (.66 p)
Electrolytic, interchangeable units for, Sept., p. 72 (.81 p)
Electrolytic, of carbide tools at Thompson Ramo Wooldridge, Feb., p. 42 (1.39 pp)
Electrolytic, of carbide tools, at Timken Roller Bearing, Feb., p. 43 (1.61 pp)
Identification plates, marking on short-run basis, Dec., p. 41 (2.5 pp)
Stainless steel tanks, of, Oct., p. 49 (2.6 pp)
Tools, clinic for, July, p. 60 (1.83 pp)
Wheels, tests for hardness of, March, p. 63 (1.94 pp)
X-ray orientation of diamond truing tools for, Apr., p. 56 (2 pp)

Heat Treating
Controlled atmospheres, types and uses of, May, p. 40 (4 pp)
Equipment, guide to manufacturers of, June, p. 52 (2.8 pp)
Flame hardening, of dies, and fixtures for, Oct., p. 53 (3 pp)
Furnaces and equipment, trends in design of, March, p. 53 (4 pp)
Metallurgy of, July, p. 48 (2.75 pp)
Quenching, Nov., p. 45 (3.5 pp)
Steel plate, with hot forming, Aug., p. 54 (3 pp)
Surface treatments, Sept., p. 56 (3 pp)

Honeycomb
Alply Sandwich, Anybody? Feb., p. 35 (1 pp)

Hydraulics
Bubbles in lines, answer to, July, p. 65 (1 p)

Inspection
Cams, semi-automatic setup for, Apr., p. 46 (.49 p)
Gears, optical system for, Jan., p. 60 (1 p)
Machine ways, of, after scraping, Nov., p. 41 (4 pp)

Lubricants
Choice of, for carbides, June, p. 62 (1 pp)

Machine Tools
European production of, Jan., p. 7 (1¾ pp)
Grinder, non-vibrating foundation for, Jan., p. 45 (2½ pp)
Historical, Aug., p. 64 (1.5 pp)
Standards, building blocks, industry agrees on, July, p. 35 (13 pp)
Transfer-type, for unusual part, Oct., p. 46 (1.1 pp)

Machining
Double-end, retooling speeds, Aug., p. 41 (2 pp)
Drilling, new production techniques, Feb., p. 55 (4 pp)
Electronic tracer drive, for, Feb., p. 51 (2 pp)
Finish milling, causes of hard spots in, March, p. 57 (3 pp)
Tape-controlled, with automatic tool changer, March, p. 50 (1 p)
Throw-away tools, with, Aug., p. 60 (2 pp)

Management
Account control, duplicate prints improve, Nov., p. 65 (1 p)
Costs, crashing them, Dec., p. 33 (1 p)
Depreciation, an element in investment decision, Feb., p. 11 (2.5 pp)
Executive development prerequisites, March, p. 6 (1.25 pp)
Inventory control, improving by training, Dec., p. 11 (1.6 p)
Labor, productivity, and competition, May, p. 20 (2 pp)
Noise, and neighbors, Dec., p. 62 (0.66 p)
Personnel, promotions of, Nov., p. 60 (1.23 pp)

Materials
Alply Sandwich, Anybody? Feb., p. 35 (1 p)
Die steel, vacuum degassed, Oct., p. 48 (1 p)
Malleable iron, advantages of, for castings, Apr., p. 44 (2.51 pp)
Nylon tubing, machined, Dec., p. 39 (2 pp)

Milling
Climb vs conventional, Apr., p. 39 (1.39 pp)
Finish, hard spots, causes of, March, p. 57 (3 pp)
With ceramics, in Europe, Nov., p. 37 (3 pp)

Parts Feeding
Automatic, for switch assembly, March, p. 47 (3 pp)

Patents
Determination of "inventorship," June, p. 57 (1 p)
Engineers and patent suits, Sept., p. 76 (1.3 pp)
Importance of keeping records of inventions, Apr., p. 51 (1.66 pp)
Inventions, problems in exploiting, Aug., p. 47 (1.66 pp)
Patent talk vs English language, March, p. 51 (1.4 pp)
Restrictions on licenses, Nov., p. 51 (2.6 pp)

Plants
Allen Mfg. Co., tour of, Feb., p. 122 (1 pp)
Gisholt Machine Co., Plastics Dept., tour of, June, p. 56 (1 p)

Plastics
Fiberglass reinforced, production of, June, p. 56 (1 p)
Gun drilling of, Sept., p. 66 (2.49 pp)
Tooling, report on current uses, Jan., p. 48 (2 pp)

Pressworking
Blanking presses, high-speed, March, p. 52 (.6 p)
Hydraulic, with welding, Oct., p. 68 (2 pp)
Laminations for pole pieces, of, June, p. 59 (2 pp)
Magnetic tooling, for, Dec., p. 47 (3 pp)
Mechanized, of stainless steel trim, Feb., p. 49 (2 pp)
"Shimmy" dies for trimming, case history, June, p. 45 (2 pp)
Stainless steel tanks formed, assembled, polished, Oct., p. 49 (2.6 pp)
Tape controlled, piercing, Dec., p. 38 (1 p)
Tonnage indicating for, Nov., p. 49 (2 pp)

Quality Control
Aircraft production techniques for, May, p. 37 (2.65 pp)
Dimensional, gaging and measuring for, Apr., p. 6 (1.5 pp)
Parts qualification programs, Sept., p. 8 (.9 p)
Program for, at Cleveland Graphite Bronze, May, p. 44 (5 pp)
Quality Pre-Control and projectors, Aug., p. 62 (2 pp)
Small lot production, program for, May, p. 49 (1.5 pp)
Statistical basis of attribute sampling, May, p. 56 (3 pp)
Systematic gage control for, Jan. p. 41 (4 pp)
Teamwork needed for, May, p. 35 (2 pp)

Reliability
Engineering, today and tomorrow, Aug., p. 37 (4 pp)
Parts qualification programs, Sept., p. 8 (.9 p)
Vacuum valve offers, Aug., p. 51 (2 pp)

Sawing
Power, simple fixturing for Apr., p. 41 (2.66 pp)

Scraping
Hand, inspection after, Nov., p. 41 (4 pp)

Spindles
Carbide, construction of, Feb., p. 124 (1.6 pp)

Standards
Building Block, industry agrees on, July, p. 35 (13 pp)

Swaging
Long tapers, of, Dec., p. 45 (2 pp)
Rotary, metallurgy of, Dec., p. 35 (2.66 pp)
Rotary, what it is and does, Oct., p. 56 (2 pp)
Valve housing tubing, application of, Jan., p. 50 (1 p)

Systems
Gage control for quality control, Jan., p. 41 (4 pp)
Tool traffic, better communication speed, Aug., p. 43 (3 pp)

Tapping
Trouble shooter's guide for, March, p. 61 (1.7 pp)

Threading
High speed, with carbides, Dec., p. 44 (1 p)

Tooling
Aluminum, its place in industry, June, p. 58 (1 p)
Make or buy, Oct., p. 74 (1.84 pp)
Optical, polygon for, Dec., p. 53 (2 pp)
Plastic, report on current uses for, Jan., p. 48 (2 pp)

Turning
Gage for lathe work, May, p. 50 (.5 pp)
Micrometer controlled lathe center, Apr., p. 60 (1.54 pp)

Welding
Automatic, by tape control, Jan., p. 54 (1 p)
Automatic, fixturing for, March, p. 60 (8 pp)
Semi-automatic, pole pieces redesigned for, June, p. 59 (2 pp)

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WHY WAIT

DELIVERY FROM STOCK

SPECIAL Right & Left Hand High Speed Taps - Dies & Thread Plug Gages

SIZE	THREADS PER INCH
0000	160
000	120
00	90-96-112
0	56-64-72-76-80-90
1	48-56-60-64-80-90
2	48-52-54-56-60-72-80-96
3	36-40-60-64-72-80
4	30-32-38-42-44-56-60-64-72-80-90
5	22-27-30-32-36-38-42-48-50-56-60-64-72-80
6	24-28-30-36-38-42-44-48-56-60-64-72-80
7	28-30-32-34-36-38-40-48-64
8	24-26-28-30-38-40-44-48-56-60-64-72-80
9	24-28-30-32-36-40
10	18-20-22-26-28-30-34-36-40-48-56-60-64-72-80-96
11	20-22-24-28-30-32-36
12	20-22-26-27-30-32-36-38-40-48-56-60-64-72-80
13	20-22-24-28-32
14	14-16-18-26-28-30-32-36-40-64
15	18-20-24-28-32
16	16-18-20-22-24-28-32-36
17	16-20
18	16-18-20-24-32-40
19	18-20
20	14-16-18-20-24-32
22	16-18-20-24
24	14-16-18-22-24
26	14-16-20-24
28	14-16-20
30	14-16-20
1/16	56-60-64-72
5/64	56-60-64-72
3/32	32-36-38-48-50-56-60-64
.107	52
7/64	36-40-42-44-48-50-56
1/8	30-32-36-38-40-48-56-60-80
.132	50
9/64	30-32-38-40
.148	38
5/32	24-26-28-30-32-36-38-40-50
11/64	24-26-30-32-36-38-40
3/16	12-18-20-22-24-26-27-28-30-32-36-40-48-56-64-72

SIZE	THREADS PER INCH
.198	24
13/64	24-28-30-32-36-40
7/32	20-22-24-26-27-28-30-32-36-38-40
.227	24
15/64	20-22-24-28-32-36-40
1/4	10-12-14-16-18-22-23-24-25-26-27-30-32-36-38-40-48-50-56-60-64-72-80
17/64	12-18-20-24-27-28-32-40
.277	40
9/32	16-18-20-24-26-27-28-32-36-40-46
19/64	18-24
.300	28
5/16	10-12-14-16-20-22-26-27-28-30-32-36-40-44-48-50-56-64
21/64	16-18-20-24-36
11/32	16-18-20-22-24-26-27-28-32-36-40-64
23/64	16-24
.365	28
3/8	10-12-14-18-20-22-26-27-28-30-32-36-40-44-48-56-64
25/64	14-16-18-20-24-27-32-40-48
.402	24
13/32	12-14-16-18-20-24-27-28-32-40
27/64	14-20-24-28-32-36
7/16	10-12-16-18-22-24-26-27-28-30-32-36-40-48-56
29/64	12-14-16-20
15/32	12-14-20-24-27-28-32-36-40
1/2	10-11-12-14-16-18-22-24-26-27-28-30-32-36-40-44-48-56-80
33/64	12-13-20-24
17/32	10-12-13-14-16-18-20-24-27-28-32-40-64
.550	24
9/16	10-13-14-16-20-24-26-27-28-30-32-36-40-48-56-80
37/64	10-12-18-20-27
19/32	12-18-20-24-28-32-36-40
5/8	9-10-12-13-14-16-20-24-26-27-28-30-32-36-40-48-56-64

SIZE	THREADS PER INCH
41/64	11-18-24
21/32	10-11-18-20-24-27-32-40-48
11/16	10-11-12-14-16-18-20-22-24-27-28-30-32-36-40
23/32	11-12-16-18-20-24-27-32-36-40
47/64	10-12-16-18-20
3/4	8-9-11-12-14-15-18-20-22-24-26-27-28-30-32-36-40-48
49/64	10-16-18-20
25/32	10-12-16-18-20-24-27-32-40
.800	16
13/16	8-10-12-14-16-18-20-24-27-28-32-40
.835	16
55/64	6-12
27/32	9-10-18-20-24-27-32-40-48
.850	14
7/8	8-10-11-12-13-16-18-20-24-26-27-28-30-32-36-40
29/32	9-12-14-18-20-24-27-28-32
15/16	8-9-10-12-14-16-18-20-24-26-27-28-32-40
31/32	8-9-12-16-18-20-24-28-32
1	5-9-10-11-12-16-18-20-24-26-27-28-30-32-36-40-48
1-1/32	8-12-14-16-18-20
1-3/64	12-14-16-18-20
1-1/16	7-8-10-12-14-16-17-18-20-24-27-28-32-40
1-3/32	7-8-9-12-14-16-18-20-32
1-1/8	8-10-14-16-18-20-24-27-28-32-40-48
1-5/32	7-8-9-12-14-16-18-20-24-32
1-11/64	18
1-3/16	7-8-10-12-14-16-18-20-24-27-32-40
1-1/4	8-10-14-16-18-20-24-27-28-32-40
1-5/16	6-7-8-10-12-14-16-18-20-24-27-28-32-40-48
1-3/8	5-8-10-14-16-18-20-24-32-40
1-13/32	12-16-18-20
1-7/16	6-8-10-12-14-16-18-20-24-27-28-32-40

SIZE	THREADS PER INCH
1-1/2	7-8-9-10-13-14-16-18-20-24-27-28-32-40
1-17/32	7-12-16-18-20
1-9/16	6-8-10-12-14-16-18-20-24-32-40
1-5/8	5-5½-6-8-10-11½-12-13-14-16-18-20-24-28-32-40
1-11/16	8-10-12-14-16-18-20-24-32
1-23/32	5-8-12-16-18-20
1-3/4	5-6-8-10-12-13-14-16-18-20-24-28-32-40
1.767	18
1.7715	12
1-13/16	8-10-12-14-16-18-20-24-32
1-7/8	5-8-10-12-14-16-18-20-24-32
1-29/32	12-16-18-20-32
1-15/16	8-10-12-14-16-18-20-24-32
2	4½-6-8-10-12-14-16-18-20-24-28-32
2-1/16	8-10-12-14-16-18-20-24-32
2-1/8	4½-8-10-12-14-16-18-20
2-3/16	8-10-12-14-16-18-20-24
2-1/4	4½-8-10-12-14-16-18-20-24
2-5/16	8-10-12-14-16-18-20-24
2-3/8	4-8-10-12-14-16-18-20-32
2-7/16	8-10-12-14-16-18-20
2-1/2	4-6-8-10-12-14-16-18-20
2-9/16	8-10-12-14-16-18-20
2-5/8	4-8-10-12-14-16-20-32
2-11/16	8-10-12-14-16-18-20-
2-3/4	4-8-10-12-14-16-18-20-32
2-7/8	4-8-10-12-14-16-18-20-24-32
2-15/16	8-10-12-14-16-18-20-32
3	3½-4-8-10-12-14-16-18-20
3-1/16	20
3-1/8	4-8-10-12-14-16-20
3-3/16	4-8-10-12-14-16-20
3-1/4	4-8-10-11-12-14-16-18-20
3-3/8	4-8-10-12-16
3-1/2	4-8-10-12-16
3-3/4	4-8-10-12-16
3-7/8	4-8-10-12-16
4	4-6-8-10-12-16
4-1/8	4-8-10-12-16
4-1/4	4-8-10-12-16

Many more sizes in stock up to 6" dia.

LEFT HAND N.C. (USS)—N.F. (SAE) SIZES

SEE ABOVE SECTION FOR MORE SIZES

SIZE	THREADS	SIZE	THREADS	SIZE	THREADS	SIZE	THREADS
0	80	8	32-36	7/16	14-20	1"	8-12-14
1	64-72	10	24-32	1/2	13-20	1-1/8	7-12
2	56-64	12	24-28	9/16	12-18	1-1/4	7-12
3	48-56	14	20-24	5/8	11-18	1-5/16	6-12
4	36-40-48	1/4	20-28	11/16	11-16	1-3/8	6-12
5	40-44	5/16	18-24	3/4	10-16	1-7/16	6-12
6	32-40	3/8	16-24	7/8	9-14	1-1/2	6-12

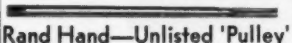
'OVERSIZE' and 'UNDERSIZE' TAPS

RIGHT AND LEFT HAND N.C. AND N.F. SIZES

MACHINE SCREW	#2 to #5	Plus or Minus .002, .003, .005
MACHINE SCREW	#6 to #14	Plus or Minus .003, .005, .010
FRACTIONAL	1/4" to 1-1/2"	Plus or Minus .003, .005, .010, .015, 1/64, 1/32

Right & Left Hand—Unlisted 'Gun' or Spiral Pointed Taps

Size	Threads	Size	Threads
0	80 NF		
1	56 NS	7/8	9 NC, 14 NF
2	56 NC, 64 NF	1	8 NC, 12-14 NF
9/16	12 NC, 18 NF	1-1/8	7 NC, 12 NF
5/8	11 NC, 18 NF	1-1/4	7 NC, 12 NF
11/16	11 NS, 16 NS	1-3/8	6 NC, 12 NF
3/4	10 NC, 16 NF	1-1/2	6 NC, 12 NF



Rand Hand—Unlisted 'Pulley' And Extra Length Taps

Size	Threads	Size	Threads
4	36-40 NC, 48 NF	3/8	24-NF
5	40 NC, 44 NF	7/16	20 NF
6	32 NC, 40 NF	1/2	20 NF
8	32 NC, 36 NF	9/16	12 NC
10	24 NC, 32 NF	9/16	18 NF
12	24 NC, 28 NF	5/8	18 NF
1/4	28 NF	3/4	16 NF
5/16	24-NF	Also Larger Sizes	NC & NF

UNLISTED Right Hand "Pipe" Taps

Taper "NPT" Size	Taper "NPT" Thread	"NPS" Size	"NPS" Thread	EX. LENGTHS "NPT" & "NPS" Size	EX. LENGTHS "NPT" & "NPS" Thread
1/16	27	1/16	27		
1/4	27	1	8		
2-1/2	8	1-1/4	11½	1/16	27
3	8	1-1/2	11½	1/8	27
3-1/2	8	2	11½	1/4	18
4	8	2-1/2	8	3/8	18
Also British		3	8	1/2	14
		3-1/2	8	3/4	14
		4	8	1	11½
		Also British		Also British	

Lefthand 'Pipe Taps' Taper and Straight

Size	Thread	Size	Thread
1/16	27	1	11½
1/8	27	1-1/4	11½
1/4	18	1-1/2	11½
3/8	18	2	11½
1/2	14	2-1/2	8
3/4	14	3	8
Also British		Also British	

The Largest Stock of

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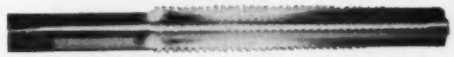

IF NOT IN STOCK—7 to 10 DAYS DELIVERY—When ordering or requesting quotations, kindly furnish following information:

(a) Kind of material being machined.
(b) Depth of hole in inches, through or bottom.
(c) Tap to be used horizontally or vertically.
(d) Will tap turn, or is piece expected to be turned.
(e) Is tapping job expected to be done in one pass.
(f) Would tap be backed out of hole, or machined stopped for release of tap.
(g) If possible, submit thread length, and overall length of tap desired with blue print.

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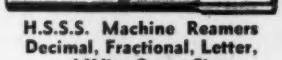
Immediate Delivery



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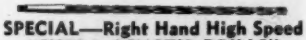

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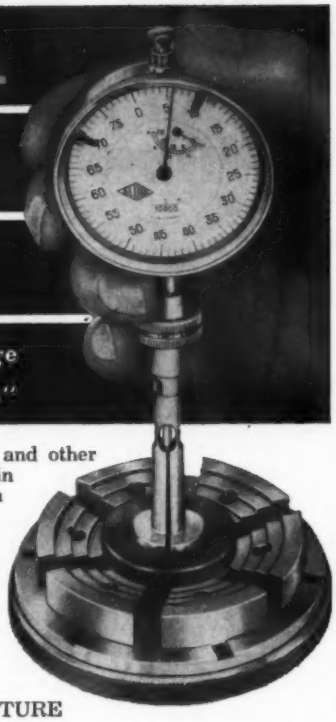

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Dial Graduated to Read .0001"

Indicates taper, bell mouth, out-of-round and other dimensional variations of bores ranging in size from .057" thru .810". ■ Simple design and rugged construction are combined to provide a reliable instrument that will always repeat. ■ 3 sets cover complete range; each set fully equipped with rings and measuring heads. ■ 2 different holders are available for production applications.

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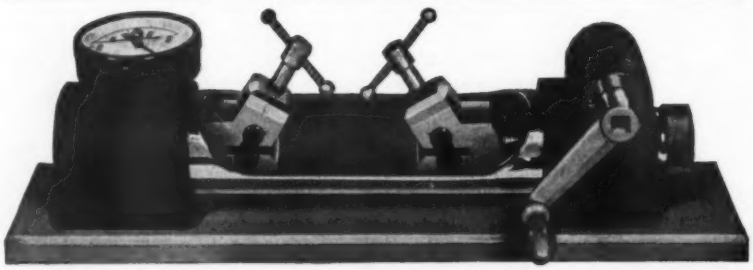

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Use this compact, precision tensile tester to test strip steel, wire, bolts, spot welds, or anything else within its 4,000 lb. capacity. Besides its use for inspection work in the shop, this portable device provides a convincing method of demonstrating the tensile strength of various materials in sales demonstrations and trade shows.

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ADVERTISER'S INDEX

Ace Drill Corporation	106
Acme Industrial Company	110
Acme Tool Corporation	97
Acro Metal Stamping Co.	91
Aget Manufacturing Co.	102
Alden Systems Co.	94
Alina Corporation	106, 120
Allegheny Ludlum Steel Corp.	83
Alva Allen Industries	121
Allenair Corp.	101
American Drill Bushing Co.	3
Anderson Bros. Mfg. Co.	77
Armstrong Brothers Tool Co.	91
Atlas Press Company, Clausing Division	24
Bald Eagle Corporation	113
Bausch & Lomb Optical Co.	23
Bellows Company	63
Benco Collet Mfg. Co.	123
Bokum Tool Co.	96
Buck Tool Company	108
Burgmaster Corporation	74
H. L. Bushman Co., Inc.	80
Capewell Mfg. Co.	20
Central Safety Equipment Co.	99
Chicago Tool & Engrg. Co.	96
Cincinnati Milling Machine Co.	51
Clausing Division, Atlas Press Company	24
Clearing Division, U. S. Industries, Inc.	124
Cleveland Tool & Die Co.	68
Cogsdill Tool Products, Inc.	79
Comet Tool Company	99
Comtor Company	112
Conical Tool Co.	114
Cook's Lead Hammer Service	89
Cooper Weymouth, Inc.	89
Danly Machine Specialties, Inc.	19
Dayton Rogers Mfg. Co.	96
Delta Power Tool Div. Rockwell Mfg. Co.	15
Detroit Reamer & Tool Co.	31
Detroit Testing Machine Co.	120
Dilley Mfg. Co.	76
The DoAll Company	7
Donley Products, Inc.	72
Dumore Company	25
Durable Punch & Die Co.	81
Durant Tool Supply Co.	111
Dykem Company	111
Edlund Machinery Corp.	21
Eisler Engineering Co.	94
Enco Manufacturing Co.	113
Erickson Tool Company	32
Ettco Tool & Machine Co.	93
Federal Press Co.	105
Fellows Gear Shaper Co.	70
Field Tool Supply Co.	119
Foredom Electric Co.	100
Futurmill, Inc.	73
Gaertner Scientific Corp.	104
Gatco Rotary Bushing Co.	101
Genesee Manufacturing Co.	101

ADVERTISER'S INDEX

Gisholt Machine Co. 61
George Gorton Machine Co. 30
Graphic Systems 97

Hamilton Tool Company 9
Hannifin Company Div., Parker-Hannifin Corp. 122
Hardinge Brothers, Inc. 28, 82
Harig Manufacturing Corp. 67
Heimann Mfg. Co. 89
Heinrich Tools, Inc. 99
Charles A. Hones, Inc. 106
Hovis Screwlock Co. 107
Huebner Publications, Inc. 60, 72, 76, 86, 115
Wm. T. Hutchinson Co. 109
Hydraulic Press Mfg. Co. 13

Ideal Industries, Inc. 117
Industrial Tectonics, Inc. 101

Jergens Tool Specialty Co. 93
C. E. Johansson Gage Co. 72

Kearney & Trecker Corp. 54

Lapeer Manufacturing Co. 115
Lepel High Frequency Labs. 102
F. J. Littell Machine Co. 96
Lovejoy Flexible Coupling Co. 98

Mahr Gage Co. 99
Jas. H. Matthews & Co. 111
Mead Specialties Company 34
Meier Brass & Aluminum Co. 18
W. F. Meyers Co., Inc. 95
Micrometrical Mfg. Co. 12
Moore Special Tool Co. 66

Niagara Machine & Tool Works 59
Northwestern Tools, Inc. 95

O'Neil-Irwin Mfg. Co. 10
Opto-Metric Tools, Inc. 76

Pedrick Tool and Machine Co. 89
Perkins Machine Co. 103
Pioneer Broach Co. 115
Pipe Machinery Co. 26
Porter Precision Products 75
Pratt & Whitney Co. 64
Prebco Bushing Co. 94
Producto Machine Co. 11
Punch Products Corp. 53

Reid Tool Supply Co. 122
J. A. Richards Co. 109
Ring Punch & Die, Inc. 102
Rockwell Mfg. Co., Delta Power Tool Div. 15
Rodgers Hydraulic, Inc. 80
Rotor Tool Company 69
Rust-Lick, Inc. 89

S-P Manufacturing Corp. 14
Sales Service Mfg. Co. 115
Scherr-Tumico Co. 104
Geo. T. Schmidt, Inc. 91
Service Machine Co. 114

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ADVERTISER'S INDEX

Sheldon Machine Co.	104
Shore Instrument & Mfg. Co.	94
R. L. Spellman Co.	89
Star Stainless Screw Co.	117
Superior Steel Products Corp.	29
Supreme Products Corp.	8
Sutton Tool Company	2
Syntron Company	84
Thriftmaster Products Corp.	95
Titan Tool Supply Co.	104
Tomco, Inc.	109
Tomkins-Johnson Co.	16
Twentieth Century Mfg. Co.	112
United States Diamond Wheel Co.	4
Universal Engineering Co.	6, 17
Vascoloy-Ramet Corp.	5
Vernon Devices, Inc.	112
Wales-Strippit, Inc.	85
Walls Sales Corp.	109
The Walton Company	76
Ward Machinery Co.	95
Wardwell Mfg. Co.	80
Watts Brothers Tool Co.	94
Webber Gage Co.	78
Weldon Tool Company	22
Wells Manufacturing Co.	112
Wespo Div., Vlier Engrg. Corp.	27
Wetmore Tool & Engrg. Co.	111
S. B. Whistler & Sons, Inc.	93
Wilton Tool Mfg. Co., Inc.	117
Woodson Tool Company	121
The Yoder Company	109

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UCTION
X
..... 104
..... 94
..... 89
..... 117
..... 29
..... 8
..... 2
..... 84
..... 95
..... 104
..... 109
..... 16
..... 112
Co. 4
.....6, 17
..... 5
..... 112
..... 85
..... 109
..... 76
..... 95
..... 80
..... 94
..... 78
..... 22
..... 112
.... 27
..... 111
..... 93
..... 117
..... 121
..... 109

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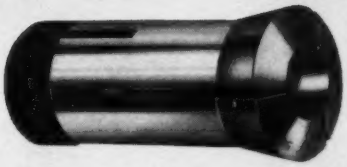

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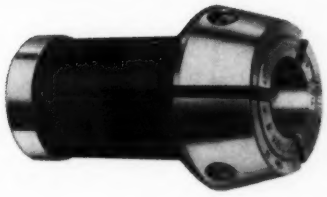

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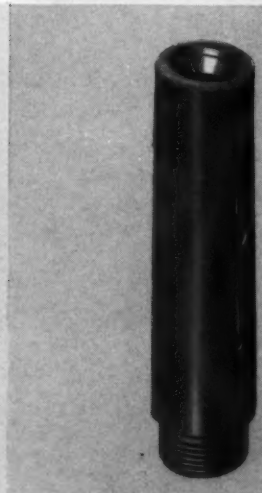

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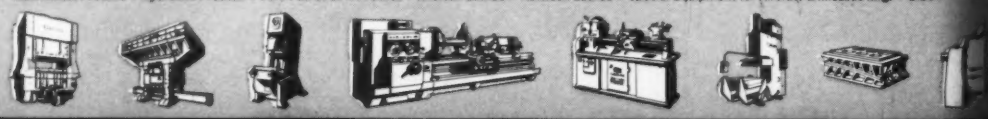

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